

# 1 SPACE ENTHUSIASMS

2. Illustration from a 19th-century edition of Jules Verne's *From the Earth to the Moon* (1865) showing a 'train' of projectiles on their way to the Moon.

**Asif A Siddiqi** is a professor of history at Fordham University in New York, who has written widely on the history of science and technology and modern Russian history. His most recent book was *The Red Rockets' Glare: Spaceflight and the Soviet Imagination 1857–1957*. He was recently appointed the Charles A Lindbergh Chair in Aerospace History at the Smithsonian Institution in Washington, DC. Here he explores the fascination with the cosmos in early Soviet culture.

The Russia of 1924 was a different world from that of just a decade before. Having gone through the traumas of the First World War, Revolution and Civil War, this was a nation hoping to look forward. And this positivist mentality was nowhere more evident than in the media which seemed to have found a new craze: space travel. The cosmos seemed to be everywhere. Prominent public figures gave talks to an enraptured public, enthusiasts joined together to discuss interplanetary flight, publishers issued books with fantastic illustrations, and a feature film on space exploration had just been released to theatres. News from abroad trickled in of likeminded space enthusiasts who wanted to travel into the farthest reaches of the solar system. This explosion of interest, some of it sober-minded and some outrageous in its imagination, inaugurated a brief but explosive period of popular fascination with space in Russia, one that fostered a mass consciousness about space travel, inspiring a generation of young people who later went on to make real what was only a dream in the 1920s.

The so-called Soviet 'space fad' of the interwar years had similar features to space

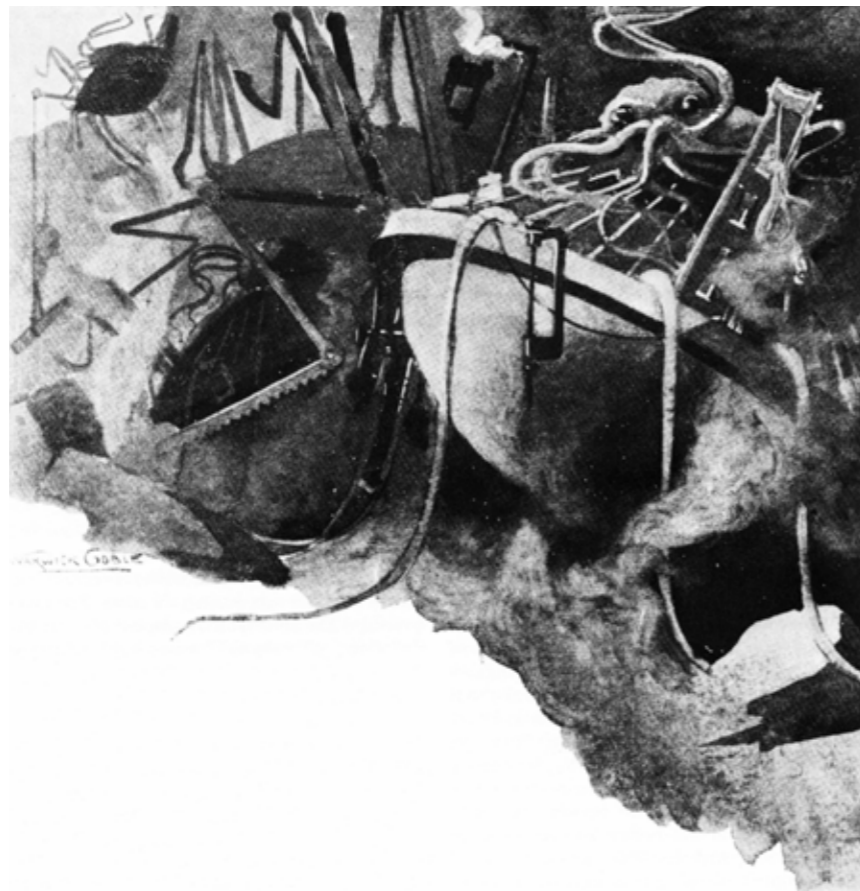
crazes in other Western nations – for example, in Germany, where there was a burst of popular fascination with astronautics – but the Soviet cosmic enthusiasm of the 1920s was distinguished both by the diversity of its perspectives and the deep historical legacy it left for one of the leading spacefaring nations on Earth.<sup>1</sup> The Soviet space fad literally carved out a 'space' for Russia in the pantheon of leading nations exploring space. Thus, when Sputnik was launched in 1957, for most Russians it was an entirely expected event: who else but Russia would be first into space?

It is a misconception to assume that the Soviet cosmic enthusiasm of the 1920s emerged fully formed, that its origins coincided with the takeover of Russia by Bolshevik rulers in 1917. In fact, Russian fascination with the cosmos can be traced much farther back, to the late 19th century, when the first translations of Western science fiction novels found their way into print. Works by French writers such as Jules Verne, Camille Flammarion and Henri De Graffigny were widely read by a growing middle class hungry for knowledge about modern science.



Verne's novels, particularly *From the Earth to the Moon* (published in Russia in the 1880s), resonated deeply with Russians who were fascinated with science and technology as their society began the process of industrialisation (figs 2, 3). Soon, native Russian writers, producing both fiction and popular science, took over the baton, and excitedly reported to their compatriots such sensational news items as the claims of American astronomer Percival Lovell that Mars was home to an advanced but now dead civilization that had built canals to transport water from its polar caps. Many of these speculations appeared in a plethora of popular science journals catering to the young adult market. These privately funded journals such as *Nature and People*, *World of Adventure* and *Around the Light* featured high-quality illustrations and delightful works on the possibility of space travel.<sup>2</sup>

Yet the fascination with space did not become a mass phenomena until after the Russian Revolution of 1917. There are several reasons for this transformation. First, the new Bolshevik leaders of the Soviet Union fully embraced a modernist impulse in bringing their nation into the 20th century. This meant unequivocally embracing science and technology as harbingers of the future. Although the Bolsheviks saw themselves as hardheaded realists, they did not close off discussions in the media of the frequently utopian yearnings of an emerging generation of young people who saw a straight line leading from the modern industrial factory to flights into interplanetary space. Another reason for the renewed interest in space was news from abroad. The American rocketry pioneer Robert Goddard and the German space theorist Hermann Oberth had both published



tracts in recent years to much acclaim if not notoriety in their own countries (figs 4, 5). As reports of their work, sometimes distorted in rather unexpected ways, began to make their way to the Soviet media, young people were inspired to discuss and popularise it, and even to look for native Russians who might have been thinking along similar lines. News of foreign achievements was, in fact, a call to action that roused the most important Russian theorist of space exploration, the village school teacher Konstantin Tsiolkovsky.

3. A Martian emerging from its machine, as depicted in the original serialisation in *Pearson's Magazine* of H G Wells's *War of the Worlds* (1898). Wells was tremendously popular with Russian readers.

### Rocket visionary

It would be impossible to recount the origins of Soviet cosmic fascination without invoking the name of Tsiolkovsky, who is most well-known for publishing in 1903 the mathematical formulae explaining exactly how it would be possible to leave the Earth and travel into space – he was the first person in the world to do so.<sup>3</sup> Tsiolkovsky was a self-educated polymath who for many years taught at a girls' school in the city of Kaluga (about 180 kilometres southwest of Moscow). His original claim to fame was through his prolific writings on metallic airships. But by the turn of the century, he had become captivated by the possibility of space travel and, in addition to his scientific meditations on rockets and spaceships, most of which were published before 1917, he also wrote at least three popular science fiction novellas.<sup>4</sup> Patterned to some degree on the work of French

writers, Tsiolkovsky's fiction was impressive more for its pedagogical importance than for its literary value, for it explained in clear language the sensations one might, for example, feel in weightlessness. These novels were rather difficult to get hold of in the 1920s, but were republished by state authorities the following decade, bringing them into the hands of thousands of younger enthusiasts who would go on to form the core engineering cohort that built the early Sputniks and Vostoks.

Historians have often claimed that Tsiolkovsky's fortunes rose dramatically after the Bolsheviks came to power in 1917 once they plucked him out of obscurity and made him a national hero. This is not entirely true. Tsiolkovsky actually had a very difficult few years after the Revolution: he was arrested by the new secret police on charges of treason (and spent a brief time in prison); he was

4. Robert H Goddard was a consummate American rocket experimenter and launched the world's first liquid-propelled rocket in 1926. He is pictured here with his apparatus for studying solar energy at Clarke University, Worcester, Massachusetts in around 1932–34.



5. Hermann Oberth, pictured in 1971 at the opening of a museum near Nuremberg dedicated to his work on spaceflight theory. He is shown holding a model of his *Kegeldüse* (cone nozzle) rocket combustion chamber.



promised a stipend but then lost it; and he was given an honorary membership in the Socialist Academy of Social Sciences but then abruptly dropped from its roster. Living in Kaluga with his large family, he was nearly destitute in the early 1920s. Yet a group of his most vociferous supporters came to his aid and actively popularised his works in the face of benign neglect from the authorities. When news of Goddard and Oberth's writings reached the Soviet press, Tsiolkovsky, hurt by the negligence of ideas in his native nation, republished his works, claiming – entirely rightly – that he had preempted both of the foreigners by decades in predicting the reality of space travel.

### Publishing popularisers

With Tsiolkovsky's name gaining national prominence from 1924 onwards, a nationwide space renaissance was spearheaded by two extraordinarily talented writers, Yakov Perelman and Nikolai Rynin. Perelman, the son of Russian Jewish intellectuals, was a tireless promoter of science who during his life published more than a hundred books and a thousand articles in various journals. He wrote what was probably the world's first serious book on space travel, published under the title *Interplanetary Travel* in 1915 and updated and expanded in several editions up to the 1930s. And he was one of the first to publicise the pioneering work of Tsiolkovsky, sustaining a correspondence with the old man that lasted for two decades. Later in his life, Perelman was a senior writer at the two most popular science journals of the day, *In Nature's Workshop* and *Journal of Knowledge*, where he explained in clear language the possibilities inherent in modern technology (fig. 7). His articles were rarely sensational but

always characterised by a palpable excitement about a future when people would be walking on the Moon or exploring the planets. According to modest estimates, 13 million copies of his works reached millions of young impressionable Russians in the early and mid 20th century.

The other great populariser, Nikolai Rynin, was a well-known academic, pedagogue and specialist in the field of aeronautics. Like Perelman he wrote much about space, and also communicated with likeminded enthusiasts abroad. In fact, one of the striking aspects of the Soviet space fad was the degree to which it was embedded in a transnational network of space activists. Rynin, for example, kept in regular contact with German, Austrian and French correspondents. Most notably, Perelman and Rynin wrote to both Robert Goddard and



7. Cover story on space exploration in the Russian magazine *In Nature's Workshop*, March 1924.

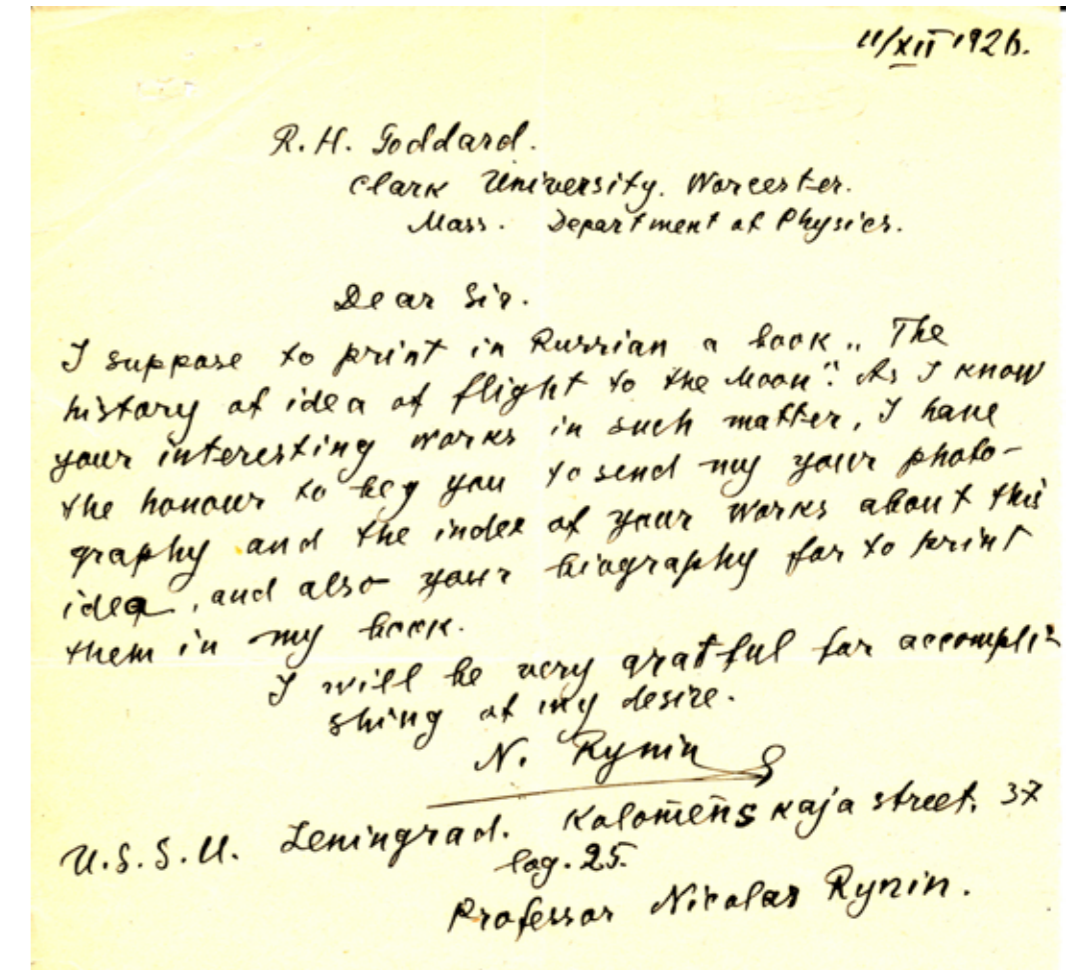
Hermann Oberth asking them for the latest information on American and German advances in the field of astronautics (fig. 1). If in general they paid special tribute to Tsiolkovsky's place in the pantheon of cosmic thinkers, they were always generous to Goddard and Oberth as fellow 'patriarchs' of this new world.

Rynin's greatest contribution and undoubtedly one of the greatest legacies of the Soviet space fad was a massive nine-volume encyclopedia under the title *Interplanetary Communications* which he authored and published between 1928 and 1932. This was a titanic work that sought to bring together everything written in any language about travel through space, including ancient folk tales, medieval speculations, modern science fiction, and the most recent works of Tsiolkovsky, Goddard and Oberth. In writing

this brilliant work, Rynin contacted hundreds of people all over the world who contributed their archives, their writings and their knowledge. The series has left for future historians a priceless record of the beginnings of humanity's earliest dreamings of travel through the cosmos.<sup>5</sup>

### Societies and experiments

Lest it seem that the Soviet space fad was one that involved only a small elite, people from all walks of Soviet life were engaged with such ideas. Many of the popular magazines of the day had lengthy letters sections ('Return Communications') publishing questions from readers which were duly answered by 'experts' such as Rynin and Perelman. Tsiolkovsky himself operated at the center of a massive international network of lay enthusiasts who



1. Letter from Soviet space enthusiast and popular science writer Nikolai Rynin to American rocket pioneer Robert Goddard in 1926, asking him to send work and biographical details for inclusion in Rynin's proposed history of ideas for flights to the Moon.

wrote to him. In many of his self-published tracts through the 1920s, he published his own address as well as the addresses of others so people could write to each other to learn the latest news. Tsiolkovsky's papers, now preserved in the hallowed halls of the Russian Academy of Sciences in Moscow, contain letters from disparate people identified under such categories as 'mining engineer', 'anti-religious person', 'metal worker', 'judge', 'telegraph supervisor', 'bookseller', 'military official', 'amateur inventor' and others.

Emboldened by the writings of Tsiolkovsky, Perelman and Rynin, such amateur and technically-minded enthusiasts formed societies to discuss their interests and exchange information on space travel. These societies – the first in the world to be dedicated to space travel – operated largely without material support or encouragement from the government. The men and women who organised the cosmic societies absorbed official Marxist discourses on the positivist role of technology as a panacea for all social ills. One of the most notable such organisations was the Society for the Study of Interplanetary Communications, formed in the spring of 1924 as a student group at the Zhukovsky Air Force Academy in Moscow. Inspired by the works of Tsiolkovsky, Goddard and Oberth, the group had an agenda that included public outreach, building a community, opening a channel of communications with Westerners, branching out into the arts through making films, and building rockets.<sup>6</sup>

The heart and soul of this society was one Fridrikh Tsander, one of the most beloved figures of the space fad (fig. 6). Raised in the Latvian capital of Riga, Tsander was an early devotee of the many science fiction

novels of the era and a convert to the cause of space exploration from an early age. Unlike Tsiolkovsky, however, who was only concerned with theory, Tsander sought to build and experiment. He became so obsessed with the cosmos that in 1922 he quit his regular job at an engine factory and devoted all his time to designing a space plane, a hobby that he sustained through the generous donations of his friends who saw in Tsander a noble if starry-eyed dreamer (fig. 8a). Yet Tsander was not a scientific dilettante. He had a masterful grasp of higher mathematics and was full of groundbreaking ideas, many of which are still to be realised. One of his most ambitious designs was for a metallic space plane that would take off using a conventional piston engine until it reached an altitude of about 28 kilometres (see



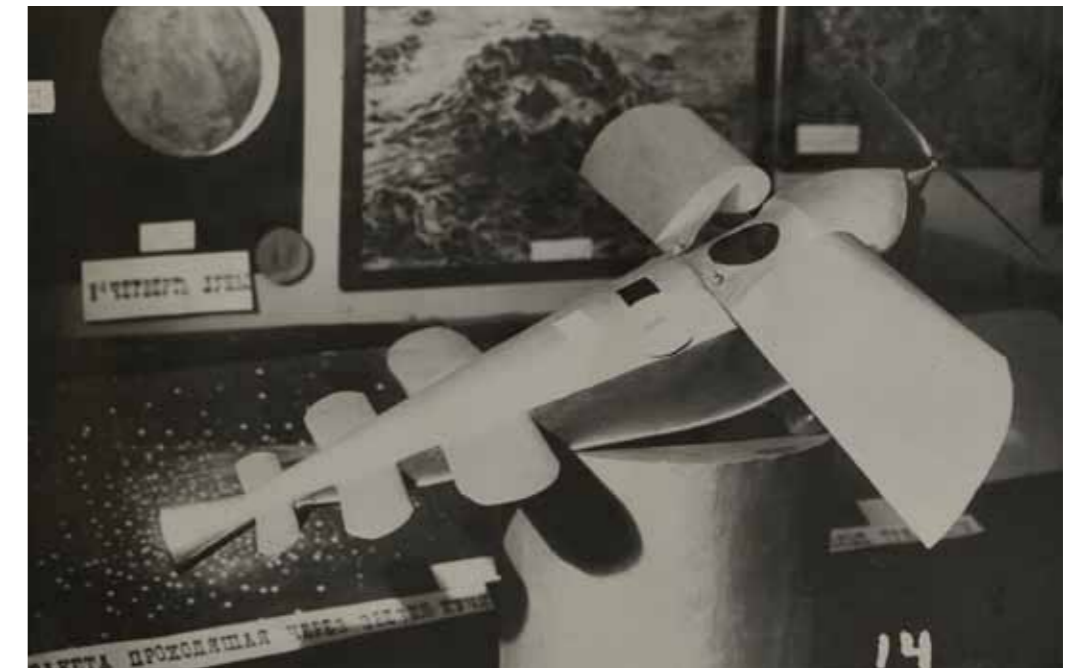
6. Soviet space enthusiasts' street flyer announcing a 'debate' on the topic 'Flight to Other Worlds' at the Physics Institute of First University, Moscow, 1924. It promises a talk by rocket pioneer Fridrikh Tsander.

fig. 4.3). At that point, the pilot would turn on a powerful rocket engine that would accelerate the vehicle into outer space. He proposed that this rocket engine would use the melted aluminum parts of its own fuselage as fuel for the engine, in combination with liquid hydrogen or liquid oxygen, a measure that, he believed, would save weight. He also analysed the problems of guided reentry into the Earth's atmosphere and various techniques of landing such a vehicle back on Earth.

The Society for the Study of Interplanetary Communications enjoyed a short but active existence. At the end of May 1924, they organized a public talk on 'Interplanetary Communications (How Modern Science Solves This Question)' presented by one Mikhail Lapirovo-Skoblo, a senior Bolshevik government official in charge of scientific and technical issues who was acquainted with Lenin. Held at the Polytechnic Museum in Moscow, the event was successful beyond all expectations. Tickets sold out two days before the event, and on the day of the lecture museum administrators were forced to call for the police to control the mass of people who had arrived to attend. Lapirovo-Skoblo concluded his lecture with a call to build

rockets to 'transform into reality the centuries-old dream of flight into space'. Nearly 180 people from the audience immediately paid dues to join the Society, headed by one Grigory Kramarov, a former political activist who had been thrown into jail by the Tsarist regime. The Society raised an astonishing 2,500 rubles from the event, enough to jump-start its activities.

One of the most memorable events hosted by the Society was the result of a misreading of the works of the American Robert Goddard who communicated briefly with its members. Based on garbled news of Goddard's plans, the Soviet press began to speculate that the American was planning to launch a rocket to the Moon timed for 4 July 1924, Independence Day in the United States. As anticipation spread in Moscow about this alleged rocket launch, space enthusiasts waited with bated breath. Yet as summer turned to fall, and there was no news, Goddard fever reached a peak. In early October, the Society held a widely advertised talk by a well-known astronomer on the topic of 'The Truth about the Dispatching of Professor Goddard's Projectile to the Moon on 4 August 1924'. The crowds outside were so unruly that the Moscow horse militia was called out to control the throng.



8a. Fridrikh Tsander's model of his Interplanetary Ship at *The World's First Exhibition of Models of Interplanetary Apparatus, Mechanisms, Instruments and Historical Materials*, in Moscow, 1927.



Opposite 8. *Aelita* film poster, 1924. This German version is subtitled 'Flight to Mars'.

**The Arts with the science**

The Society had aspirations to produce cinematic representations of space travel, a goal which it unfortunately failed to live up to, but which famous Soviet director Yakov Protazanov fulfilled. Known as one of the founding fathers of Russian cinema, Protazanov was already famous by the time of the 1917 Revolution but his legacy was sealed by the 1924 adaptation of the popular novel *Aelita*, authored by the Russian writer Alexei Tolstoy. Tolstoy's original novel described an attempted proletarian revolution on Mars instigated by two visitors from Earth. In drawing on Tolstoy's already rich novel, Protazanov transformed the story into an ambiguous and beautiful parable that communicated a veiled message about the

state of Soviet culture during a time of great uncertainty (fig. 8). Film critics have called *Aelita*, officially released in the fall of 1924, one of the great silent films of the early 20th century and an early example of the modernist aesthetic in world cinema, prefiguring many of the tropes that were evident in the more famous German movie *Metropolis* (1927). *Aelita*'s triumph had to do less with its plot, which Protazanov transforms into a subtle meditation on the allure of bourgeois domesticity, than with the extravagant constructivist sets and special effects depicting space travel. The film was hugely influential and sold out its initial runs all over Soviet Russia although it was increasingly subjected to critique as the decade wore on. Eventually, it fell victim to the draconian

9. Poster for the film *The Cosmic Voyage*, 1936, prefaced as a 'science fiction film'.



ensorship of the Stalinist era of the 1930s. Yet the film – as well as a later, more traditional space-themed movie, *The Cosmic Voyage* (1936), directed by Vasili Zhuravlyov – made an indelible impression on many, including young Soviet space enthusiasts who for the first time could picture launches of rockets and the experience of being weightless in space (fig. 9). The patriarch of Soviet space travel, Tsiolkovsky himself, advised Zhuravlyov on the proper way to depict the state of weightlessness (see fig 11, chapter 2 for some of the illustrations Tsiolkovsky drew to help Zhuravlyov).

Film was not the only artistic medium that engaged with space exploration. In the early 20th century, Soviet artists were captivated by the possibility of space travel.<sup>7</sup> The most famous of them were the suprematists, avant garde painters concerned with unusual representations of space and perspective (fig. 11). Led by the charismatic Kazimir Malevich, many suprematist painters produced works that explicitly or implicitly portrayed a world without gravity, a universe without reference points.<sup>8</sup> In such paintings as *Cosmic Landscape* (1923) by Boris Ender, Soviet artists sought to convey on canvas their belief that art could depict the future relocation of humanity into the expanse of the cosmos. As early as 1916 Malevich had written, ‘Earth has been abandoned like a worm-eaten house. And an aspiration towards space is in fact lodged in man and his consciousness, a long to break away from the globe of the Earth.’ Some of Malevich’s most famous paintings of the period, such as *Suprematism* (1917) and *Drawing* (1918), depict objects not dissimilar to what we might today call space stations or futuristic cities in the cosmos. While Malevich never alluded to them as such, the paintings evince a remarkable

understanding of the basic concepts of the passage of objects through weightlessness. Other Malevich followers, such as El Lissitzky and Georgy Krutikov, explored a new type of architecture designed for ‘flying cities’. These ideas stemmed not only from a fascination with the cosmos but also from a utilitarian view that living space on the Earth was limited and that humanity had to devise other spaces for habitation.

Literature was another medium for an expression of cosmic enthusiasm in the 1920s and 1930s, most obviously expressed in what we might today call science fiction, but in the Russian idiom was identified as *nauchnaia-fantastika* or ‘scientific-fantasy’. Most space fiction tended to be firmly in the young adventure mould, not unlike James Bond stories set in space. A representative Soviet version was *Stories about Mars* (1925) by Graal-Arelsky (real name Stefan Petrov). In a style directly copied from Edgar Rice Burroughs, Arelskii treated the laws of physics as entirely malleable if a new plot twist required them to be adjusted. Other more serious works from the pre-Revolutionary days, such as Aleksandr Bogdanov’s *Red Star* (originally published in 1908), were reprinted in the Soviet era, and were immensely popular narratives about travel through space while simultaneously advancing the benefits of socialism.

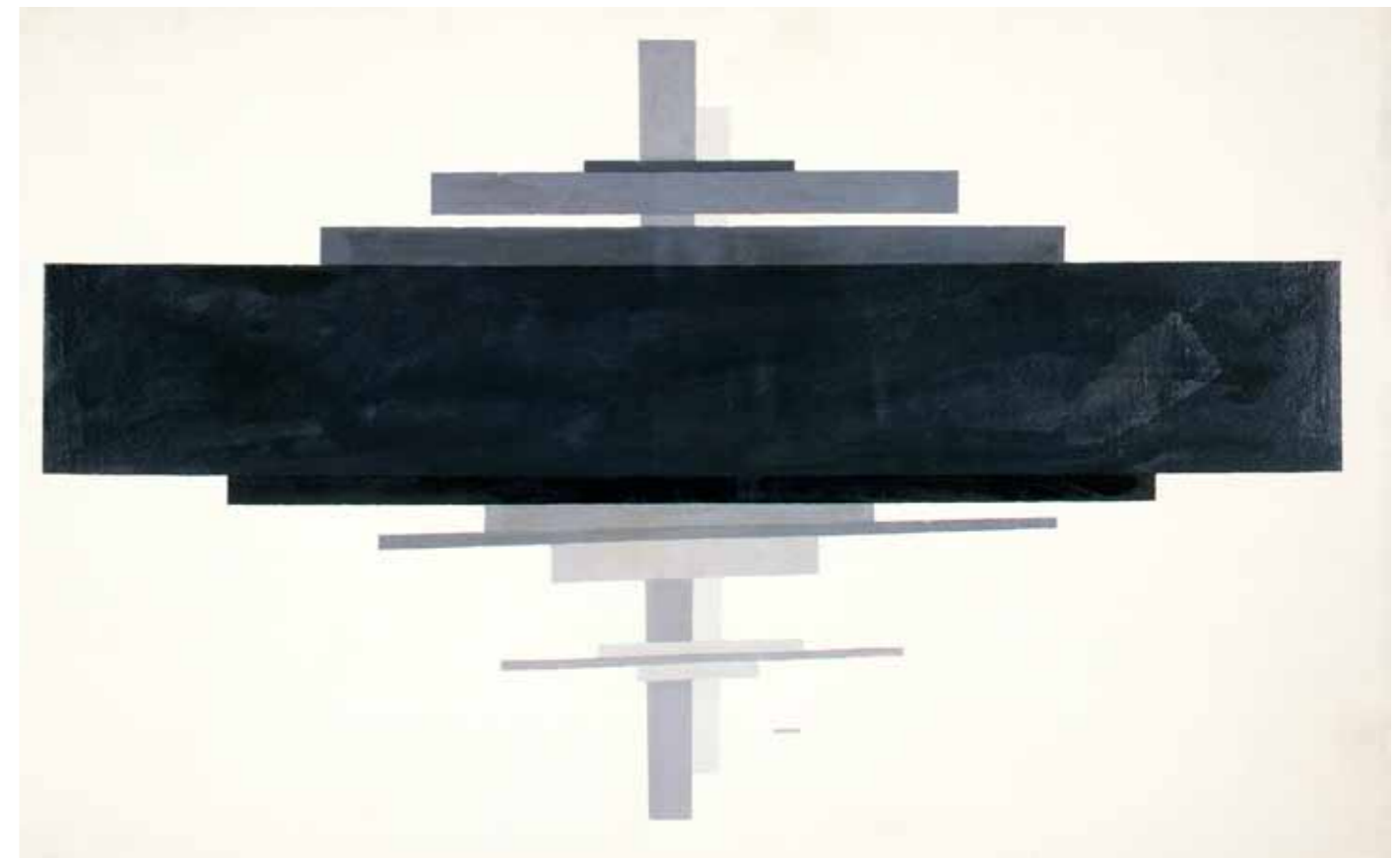
Aleksandr Belyayev, often called the ‘Soviet Jules Verne’, was another popular writer. Belyayev’s eagerness about the glorious future of communism was underlined particularly by his question to People’s Commissar of Enlightenment Anatoly Lunacharsky on what elements should underscore an ideal Soviet science fiction novel; the answer he received,

Ilya Chasnik, *Suprematism*, 1925. Suprematist leader Kazimir Malevich expressed a revolutionary idea of creating an interrelation between celestial bodies through ‘a new suprematist satellite, which will move in orbit’, an idea reflected here in Chasnik’s complex structured form, suspended in white depthless space.

“the struggle of the old with the new,” captures much of the zeitgeist of the literature of this period. In Belyayev’s *Struggle in the Ether* (1928), workers from a super-industrialised America, transformed into robots of the Taylor system, battled with communists in space. Although not critically acclaimed at the time, Belyayev has been evaluated less harshly in later years, perhaps because he provided such a boost to the genre of Soviet science fiction via his almost 20 novels. Packed with fantastic technology, lucid explanations and compelling writing, Belyayev’s works tried to achieve what he considered the goal of science fiction, ‘to serve humanism in the biggest, universal conception of this word.’<sup>9</sup>

There was one more medium that space enthusiasts used to foster discussion about space travel, the public exhibit. After a few aborted attempts in 1925, a number of self-described *kosmopolity* organised what was

surely *The World’s First Exhibition of Models of Interplanetary Apparatus, Mechanisms, Instruments and Historical Materials* in Moscow in the spring of 1927. Having culled materials from a huge network of people (they even wrote to Goddard and Oberth), the organisers did not want for ambition. One of the organisers, Mikhail Popov, described the feeling of entering the exhibition: ‘By taking a pair of steps, I crossed over the threshold of one epoch to another, into space.’ Preserved photographs of the exhibition show a highly stylised space with curated materials describing a narrating history of space travel, from the technological anticipations of the 19th century to the more sober-minded prognostications of famous figures such as Tsiolkovsky, Tsander, Goddard, Oberth and others (see fig 2, chapter 3). The show, held entirely without state support, was a major success. The many visitors included school children, workers, service employees, artists,



scientists, policemen and such luminaries as the world famous Soviet poet Vladimir Mayakovsky. Visitors, who were also invited to record their impressions, were unusually enthusiastic. One person, who signed as ‘Gorev’, wrote, ‘Our mind is not accustomed to all the “wonderful and unknown” which literally was seen and heard, as if in a dream, yet we understand that this is not a fantasy but a completely feasible idea supported by the achievements of science and engineering.’ Another person, an artist from the Third State Cinematographic Studio, added, ‘It would be desirable that our inventors achieve the first landing on the Moon,’ a goal that the Soviet Union actually achieved with a robot 32 years later. One of the most taken was S G Vortkin, a reporter from the workers’ news daily *Working Moscow*, who wrote: ‘I am going to accompany you on the first flight. I am quite serious about this. As soon as I heard what you had done, I tried in every way to make certain that you would take me with you. Please do not refuse my request.’

By the mid-1930s, the Soviet space fad was essentially over. Some have suggested that there was deliberate suppression of such utopian ideals, the state having equated cosmonautics with idle diversions from the more urgent matters of the day, particularly Soviet industrialisation and collectivisation. There is some truth to this, but one must keep in mind that the Soviet Bolshevik Party and the government rarely, if ever, supported the space fad and said almost nothing about it, especially in the 1920s and early 1930s. While it is true that the Bolsheviks began to publicly exalt and honour Konstantin Tsiolkovsky in the 1930s, in the last three years of his life, the state’s eagerness had to do less with Tsiolkovsky’s

chosen interests such as airship design or space travel than with the fact that he was a self-educated person who was able to be creative outside of the old elitist system of education and science in Russia.

The space fad, which was fostered by the dissemination of science fiction, ended in the mid-1930s not because of the state’s active efforts to eliminate such utopian thinking, but for reasons of practicality and diminishing interest. First, private publishing concerns, which had been the biggest sponsors of the literature on space, were gone by the early 1930s. Second, the growing Soviet national fascination with aviation, having more inspirational power as a marker for modern technology to a populace turning away from idle dreaming, absorbed the space discourse and refashioned it into something more ‘real’.<sup>10</sup> By the mid-1930s, the terminology of ‘interplanetary communications’ receded in favour of more ‘real’ goals in line with such possibilities as jet propulsion and stratospheric flight.

Yet the dream of Soviet space flight in the 1920s differed in significant ways from the fascination with aviation. Space was about liberation from gravity in a much more emphatic manner. Space was also a discourse of fantasy. No one after all had ever seen a real spaceship. For a brief period in the 1920s, space flight was the most potent manifestation of the ‘fantasy of liberation’, and indeed may be seen as a kind of ‘liberation of fantasy’. And as one single force – a combination of technology, liberation and fantasy – space flight for a brief and wonderful period in the 1920s offered what aviation could only offer in part, total liberation from the signifiers of the Russian past: social injustice, imperfection, gravity and, ultimately, the Earth.

1 For the German ‘space fad’ see Michael J Neufeld, ‘Weimar Culture and Futuristic Technology: The Rocketry and Spaceflight Fad in Germany, 1923–1933, *Technology and Culture*, 31 (October 1990), pp 725–52.

2 For a detailed overview of this explosion of popular science in Russia in the late 19th century, see Asif A Siddiqi, *The Red Rockets’ Glare: Spaceflight and the Soviet Imagination, 1857–1957* (New York: Cambridge University Press, 2010), pp 16–42.

3 Tsiolkovsky’s original mathematical work was published in the Russian journal *Scientific Survey*, 5 (1903): pp 45–75. A supplement to the original work appeared in the Russian media in an eight-part article published in the journal *Herald of the Air Fleet* in 1911 and 1912. A third part appeared in a self-published monograph in 1914.

4 These three novellas were *On the Moon* (originally published in 1893), *Dreams of the Earth and Sky and the Effects of Gravitation* (1895) and *Beyond the Planet Earth* (1918). He also published a number of shorter fictional works in various journals.

5 While the original nine volumes in their Russian editions are extremely rare, NASA sponsored a translation of the set into English in the 1960s which are readily available in most libraries that contain U.S. government documents.

6 For a detailed history of this group, see Asif A Siddiqi, ‘Making Spaceflight Modern: A Cultural History of the World’s First Space Advocacy Group’, in Steven J Dick and Roger D Launius (eds), *Societal Impact of Spaceflight* (Washington, DC: NASA, 2007), pp 513-537.

7 For a summary of the artistic responses to the Soviet space fad, see Siddiqi, *The Red Rockets’ Glare*, pp 74–113.

8 There is a vast canon of work on Malevich and Suprematism. For a recent scholarly example, see Aleksandra Shatskikh, *Black Square: Malevich and the Origin of Suprematism* (New Haven, CT: Yale University Press, 2012).

9 For a recent exploration of Russian and Soviet science fiction, see Anindita Banerjee, *We Modern People: Science Fiction and the Making of Russian Modernity* (Middletown, CT: Wesleyan University Press, 2013).

10 For Soviet aviation, see Scott W Palmer, *Dictatorship of the Air: Aviation Culture and the Fate of Modern Russia* (New York: Cambridge University Press, 2006).