Clear views from Chile's Paranal Observatory are protected through agreements to limit light pollution by neighbouring mines.

he does not travel into space to visit the Planck spacecraft in person, he writes of how its forthcoming results on the cosmic microwave background will soon challenge cosmologists' knowledge of the early Universe.

The Edge of Physics is an accomplished and timely overview of modern cosmology and particle astrophysics. Ananthaswamy's characterizations of the many physicists he meets are on the mark; yet the actors' number and brevity on the stage may baffle the uninitiated. It is especially gratifying that he spends time with the dedicated technicians and support staff, not just the big scientific names.

Ananthaswamy conveys that cutting-edge science is a human endeavour. Ending his journey, and his story, at India's Hanle observatory in the Himalayas, he again notes the confluence of an observatory and a monastery at a remote location. He urges that these sites must be protected from environmental threats such as climate change and oil pipelines. A more pressing brake to grand experimentation is the global recession. Yet his interviews show that understanding ultimately comes from individual curiosity and motivation, not expensive equipment. Perhaps in the quieter economic times ahead, physicists will have more liberty to contemplate the Universe around them.

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Genius who shuns the limelight

Perfect Rigor: A Genius and the Mathematical Breakthrough of the Century

by Masha Gessen

Houghton Mifflin Harcourt: 2009.

256 pp. \$26

Mathematics rarely makes the news. One exception was the proof of the century-old Poincaré conjecture in 2003. When Russian mathematician Grigory 'Grisha' Perelman posted his solution on the Internet, people took notice. Experts found that it was correct and Perelman was awarded the highest honour in maths, the Fields Medal, by the International Mathematical Union in 2006. Yet the laureate refused to attend the award ceremony in Madrid, leaving King Juan Carlos, who was to present the medal, waiting in vain. Media interest again soared: here was a long-haired weirdo who had flouted the King, thus confirming every prejudice about mathematicians. Tales of priority disputes and plagiarism quickly followed.

Given his supreme problem-solving ability and eccentric behaviour, Perelman's personality begs analysis. *Perfect Rigor* fills that need. Science writer Masha Gessen has researched the reclusive mathematician thoroughly, interviewing his teachers, maths coaches and colleagues in the United States, Russia and Israel. She also consulted psychologists about his behaviour, which, she suggests, has much in common with Asperger's syndrome.

Born in St Petersburg (at that time Leningrad), Perelman became a maths prodigy. At 16 he won a gold medal at the 1982 International Mathematical Olympiad with a perfect score. After studies at Leningrad State University, the Steklov Institute of Mathematics in St Petersburg and a postdoc at the University of

California, Berkeley, he vanished for several years. None of his colleagues knew it, but he was working in solitude on a proof of the Poincaré conjecture — a famous problem in topology about three-dimensional boundaries of four-dimensional spheres. After reappearing briefly to explain his proof in a whirlwind US tour, he vanished again. His whereabouts today are unknown.

Gessen describes the best and the worst that Soviet maths had to offer; the best being the support given to gifted youths such as Perelman through maths clubs and competitions, the worst being the rampant anti-Semitism that pervaded maths departments until perestroika in the late 1980s. Had it not been for the strenuous efforts of some professors to support Perelman, even a prodigy of his stature might have been prevented from pursuing graduate studies because of his Jewish background. Gessen, a self-described 'maths junkie' brought up in Moscow, is ideally placed to tell of discriminatory practices in the Soviet academic world — her parents are Jewish engineers who suffered through such ordeals.

The book falls short in one important respect: like others who have tried, Gessen was unable to contact Perelman in person. Putting on a brave face, she writes that she was not burdened by any allegiance to Perelman's narrative. Unfortunately, lacking tangible facts, she nevertheless speculates on why he shunned both the medal and the public. Without any evidence from supporting interviews, Gessen suggests that his great achievement made him condescending towards the work of others. This guesswork is unwarranted. One person who knows the Russian mathematician's true motives is John Ball, the then-president of the International Mathematical Union who travelled to St Petersburg in an attempt to persuade Perelman to accept the award. Ball reveals only that Perelman was allegedly disappointed by the dishonourable behaviour of some unnamed mathematicians. Gessen, by proffering gratuitous speculations, both misleads the reader and does Perelman grave injustice.

Until 2006, the Poincaré conjecture was one of the most famous open problems in maths; now it is one more theorem. For Perelman, proving the conjecture was sufficient reward in itself — no prize or recognition was needed. *Perfect Rigor* reminds us that it is journalists and the public who want more.

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Grigory Perelman disappeared after proving the Poincaré conjecture about the topology of a sphere.