

# Intuition, Simplicity, Elegance



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Prof. Marek Abramowicz is a prominent astrophysicist  
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**The Polish Astronomical Society first awarded the Bohdan Paczyński Medal during its 36th convention in Warsaw on 14 September 2013. The award was presented to Prof. Martin Rees from the University of Cambridge**

A one-page article is not enough even to list all of Prof. Rees's outstanding achievements, let alone to describe them. I shall therefore restrict myself to a single accomplishment, one that in my opinion offers a good example of the professor's insightful physical intuition as well as the effective simplicity and elegance of his mathematic calculations. As a PhD student under Dennis Sciama at Cambridge, Rees published the paper "Appearance of Relativistically Expanding Radio Sources" in *Nature* in 1966. He explained why an object traveling near the speed of light in a direction close to the line of sight may appear to an observer to have a transverse velocity greater than the velocity of light! As predicted by Rees, the illusion of superluminal velocities is indeed observed in narrow streams of matter (jets) ejected from certain active galactic nuclei, in our galaxy from microquasars. As Rees explained, the very fact that the illusion is observed means that the real velocities of jets must be huge, up to 99% of the speed of light in some sources.

Bohdan Paczyński, the late Polish astronomer after which the prize is named, was himself highly appreciative of the mathematic simplicity of Rees's findings. Such results can be derived from several lines of elementary trigonometric calculations, directly from kinematics. There is even no need to use the special theory of relativity! "It would appear that anyone could have predicted the observed illusion of superluminal velocities (...)" Paczyński once said. "Fundamentally profound truths can be simple, but this simplicity is usually noticed first only by the greatest of minds."

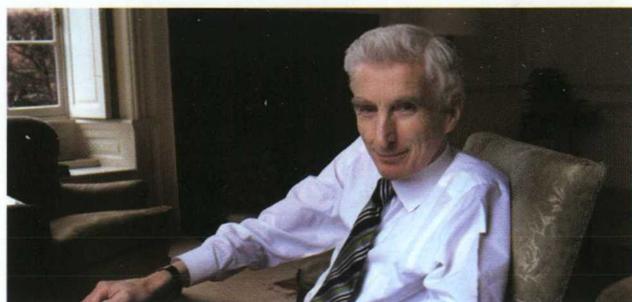
Although we now understand very well why a jet traveling at 99% of the speed of light may appear superluminal, we do not know yet all the significant details of the physical processes that cause matter to accelerate to such huge velocities.

Rees has spent many years working to resolve the mystery of jets, both alone and with his associates. One prominent member of this group is Prof. Marek Sikora. Sikora

and Rees have published four papers together, the most frequently cited one being "Comptonization of diffuse ambient radiation by relativistic jet: The source of gamma rays from blazars?" by M. Sikora, M.C. Begelman, and M.J. Rees, published in *The Astrophysical Journal* in 1994. Another Polish astronomer who has published papers together with Rees is Prof. Andrzej Zdziarski. I am mentioning in particular these colleagues of mine from the PAS Nicolaus Copernicus Astronomical Center because the rules of awarding the Bohdan Paczyński Medal stipulate that it may be presented to a person "linked to Polish astronomy."

Of course, Martin Rees has not restricted himself to publishing papers with Polish astronomers. I remember his decisive role in the international promotion of the (theoretical) discovery of thick accretion disks surrounding black holes made by Bohdan Paczyński's group in the 1970s. Martin invited us to Cambridge to present our findings to an international audience. He himself presented our theory in several opinion-leading journal articles. Finally, he suggested the name "Polish Doughnuts" for thick discs. Together with his PhD students, Rees developed the ion torus model, a special type of such discs. At present, I am using the model to study accretion on Sgr A\*, the supermassive black hole in the center of our galaxy. ■

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Martin Rees graduated from the University of Cambridge. He is a fellow of the Royal Society and served as its president in 2005-2010. He has been Astronomer Royal since 1995. He served as Master of Trinity College at Cambridge for several years. He has won numerous titles, distinctions, and awards, including the title of Baron Rees of Ludlow and the Order of Merit. He won the Balzan Prize, the Crafoord Prize, the Templeton Prize, and the Isaac Newton Medal. Just like Bohdan Paczyński, he received the Heineman Prize, the Gold Medal of the Royal Astronomical Society, the Bruce Medal, the Bruno Rossi Prize, and the Henry Norris Russell Lectureship. He has made groundbreaking discoveries in the theory of active galactic nuclei, gamma-ray bursts, the astrophysics of black holes and black hole accretion as well as other branches of modern astrophysics and cosmology. As a result of the significance of his discoveries, Martin Rees is one of the world's most frequently cited astrophysicists. He has an h-index of over 100.