Il Colle di Galileo

HERAEUS 2019: 100 Years of Gravitational Lensing

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Abstract. The cycle of activities of Heraeus also began in 2019, with this year's theme being the study of gravitational lenses, their operation and what they tell us about the universe around us.

Keywords. Teaching, Relativity, Gravitational Lenses.

(text by Niccolò Bucciantini)

Once again this year, the bilateral Italy-Germany initiative "Heraeus: Astronomy from the Four Prospective" has been renewed: a series of lectures aimed at high school teachers and students of master courses in Physics and Astronomy, with the addition, in late summer, of a week of workshops, at one of the four institutes that organise these events (the Universities of Heidelberg and Jena, for Germany, the Universities of Padua and Florence, together with the relative INAF observatories for Italy).

The theme chosen for this year is gravitational lenses. Just 100 years ago, in 1919, the theory of General Relativity was confirmed by the measurement of the deflection of light from distant stars due to the gravitational field of the Sun. Today, after multiple confirmations, we know that the study of the deflection of light, and the phenomenology connected to it, can provide information on the distribution of matter in the Universe, which would be otherwise inaccessible.

It is thanks to the deflection of light in clusters of distant galaxies that we can see how the curvature of space time implies the presence of much more mass than we can observe, the so-called dark matter. Again, using gravitational lensing phenomena we are able to measure the mass of neutron stars in binary systems with very high precision. Effects of weak gravitational lenses on cosmic background radiation allow us to constrain some cosmological parameters linked to the primordial phases of the Universe. Last but not least is the recent image of the black hole in the middle of M87.

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The Heraeus programme includes a series of lessons conducted by researchers from the University of Florence and the Arcetri Observatory who are more closely involved in research in the Astrophysical field, on the topics of General Relativity, Compact Objects and Cosmology. The purpose is to introduce the subject to the public and to train those who work in or plan to deal with higher education, through direct contact with those who conduct scientific research, so as to guarantee constant updates. This year's summer school will take place at the University of Jena, Germany, offering the opportunity to compare Italian and German teaching experiences.