

Symposium on Gravity and Light

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An international workshop called “Symposium on Gravity and Light” was held at Kavli IPMU for four days, September 30 to October 3, 2013.

Light is our main source of information about the distant, early universe — indeed, until gravitational waves and extragalactic neutrinos can be observed directly and routinely, it is the only source. So in order to study the origin and evolution of the universe, it is fundamentally important to understand light propagation in spacetime under the influence of gravity alone, even before taking into account other astrophysical effects such as absorption. Hence, this workshop was dedicated to gravitational optics in a broad sense.

Black hole spacetimes were a major theme since the influence of gravity on light is, of course, seen most clearly when it is strong. Starting with optical geometry and the Gauss-Bonnet method (Marcus Werner), we discussed stable photon orbits, which are analogous to “whispering galleries” (Gary Gibbons), extreme trapping horizons of black holes (Tetsuya Shiromizu), and the properties and observability of black hole shadows (Kei-ichi Maeda and Volker Perlick).

Since the optical geometry of rotating Kerr black holes has Randers-

Finsler structure, more general mathematical results on geodesics (Erasmus Caponio and Ricardo Gallego Torromé) and Killing vectors (Takayoshi Otsuka) in Finsler geometry were presented as well. Mathematical aspects of gravitational lensing theory were also considered, in particular universal magnification invariants for ADE singularities (Amir Aazami), and magnification relations for perturbed singular isothermal quadrupole lenses (Zhe Chu).

Testing cosmology with gravitational lensing was another major theme and included a review of the recent controversy about the rôle of the cosmological constant in light bending (Masumi Kasai), lenses with negative convergence, which may be used as effective models for cosmic voids (Hideki Asada), as well as tests of the homogeneity postulate and observational prospects (Jean-

Philippe Uzan). We also discussed the underlying gravity theory, in particular inflation (Misao Sasaki), and a new geometrodynamical framework to derive gravity actions, in which light dispersion relations are fundamental (Frederic Schuller).

Thus, in keeping with the interdisciplinary spirit of Kavli IPMU, our workshop brought together astronomers, theoretical physicists and mathematicians, which did in fact result in rather lively and sometimes controversial discussions.

Finally, I would like to thank the other organizers of this workshop, Amir Aazami, Frederic Schuller and especially Shinji Mukohyama for leading the conclusion session, and also our staff members, in particular Rie Ujita and Rie Kohama, for their administrative support.

