

Cosmological Microlensing

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The first part of this workshop lecture provides an overview on Cosmological Microlensing. In the second part, practical exercises and advice are offered to the workshop participants in how to use the ray-shooting microlensing program. After a few historical remarks on the most influential scientists in this field (Einstein, Chang & Refsdal, Gott, Paczyński) the basics of microlensing are introduced: the geometry, the lens equation, the Einstein radius, the scalings. The various microlensing phenomena are described: stellar and quasar microlensing, near and far microlensing, low and high optical depth microlensing. The double quasar Q0957+561 and the quadruple quasar Q2237+0305 are introduced as good example cases for microlensed quasars. A number of recent microlensing applications are presented: The flux ratio anomaly in some of the close image pairs of quadruple quasars is explained with respect to "depressed saddle points"; limits on the transverse velocity of a lensing galaxy are derived; microlensing of odd images is investigated; astrometric microlensing is illustrated; and the effects of quasar shapes and profiles are explored. In the second part of the lecture, the inverse ray-shooting microlensing code is presented and introduced. The tree-code approach is illustrated, the parameters of the program are described, and possible sources of (numerical) problems are discussed. Tools how do display and analyse the results are presented: two-dimensional magnification patterns, lightcurves as one-dimensional cuts convolved with a quasar luminosity profile. For subsequent practical exercises, the workshop participants were provided with the ray-shooting program.

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The contribution is appended in original form as slides of the presentation. The publications that are referred to on the slides are listed here:

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