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Limits on primordial black holes as dark matter from two decades of the OGLE survey

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The idea that dark matter may be composed of dark compact objects, such as primordial black holes, was revived following the discoveries of gravitational waves from mergers of massive black holes by the LIGO and Virgo detectors.

If such black holes existed in large numbers in the Milky Way dark matter halo, they would cause long-timescale gravitational microlensing events lasting years. Previous experiments that aimed to detect gravitational microlensing events from dark matter halo objects were not sensitive to such long-timescale microlensing events and, thus, not sensitive to such massive black holes.

In this talk, I would like to present the results of the search for the long-timescale microlensing events amongst the light curves of nearly 80 million stars located in the Large Magellanic Cloud (LMC) that were monitored for 20 years (2001-2020) by the OGLE survey.

We did not find any events with timescales longer than 1 yr. The properties of all thirteen microlensing events with timescales shorter than 1 yr detected by OGLE toward the LMC can be explained by stars and brown dwarfs located either in the LMC itself or in the Milky Way disk, without the need to invoke dark matter in the form of compact objects.

We find that compact objects in the mass range from 1.4e-8 (half of the Moon mass) to ˜10 solar masses cannot compose more than 1% of dark matter, and compact objects in the mass range from 3.5e-9 to 860 solar masses cannot make up more than 10% of dark matter. The weaker limits extend up to 10ˆ4 solar masses.

Our limits are more than an order of magnitude stronger than those inferred by all previous gravitational microlensing experiments that aimed to assess the contribution of compact objects in the relevant mass range to dark matter.

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