

Probing Dark Matter at LIGO and Beyond

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Abstract

What can we learn about Dark Matter frontiers with Gravitational-Wave (GW) observations at LIGO and future detectors?

We first introduce a new GW observable — GW Fringe — that allows LIGO alone to already probe compact dark matter such as primordial black holes or dark-matter stars. We further discuss that by augmenting LIGO with mid-frequency detectors, one can also probe various other dark matter kinds in yet other new ways. Such dark matter candidates include fuzzy axion-like dark matter and cosmic strings. A capability of ideal localization is a bonus of such broadband detection. All these new opportunities utilize the unique chirping nature of GWs from binary mergers.

The new opportunities can not only strengthen LIGO science capabilities, but also motivate future mid-frequency detectors. Most importantly, they are precious new ways to understand the particle-physics nature of dark matter via GW — the new eye of the Universe.