A Search for Decaying Dark Matter in Galaxy Clusters and Galaxies with IceCube

Minjin Jeong on behalf of the IceCube Collaboration
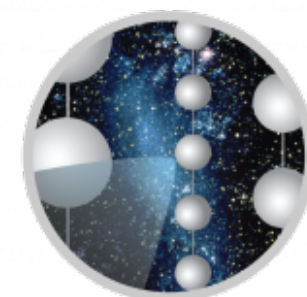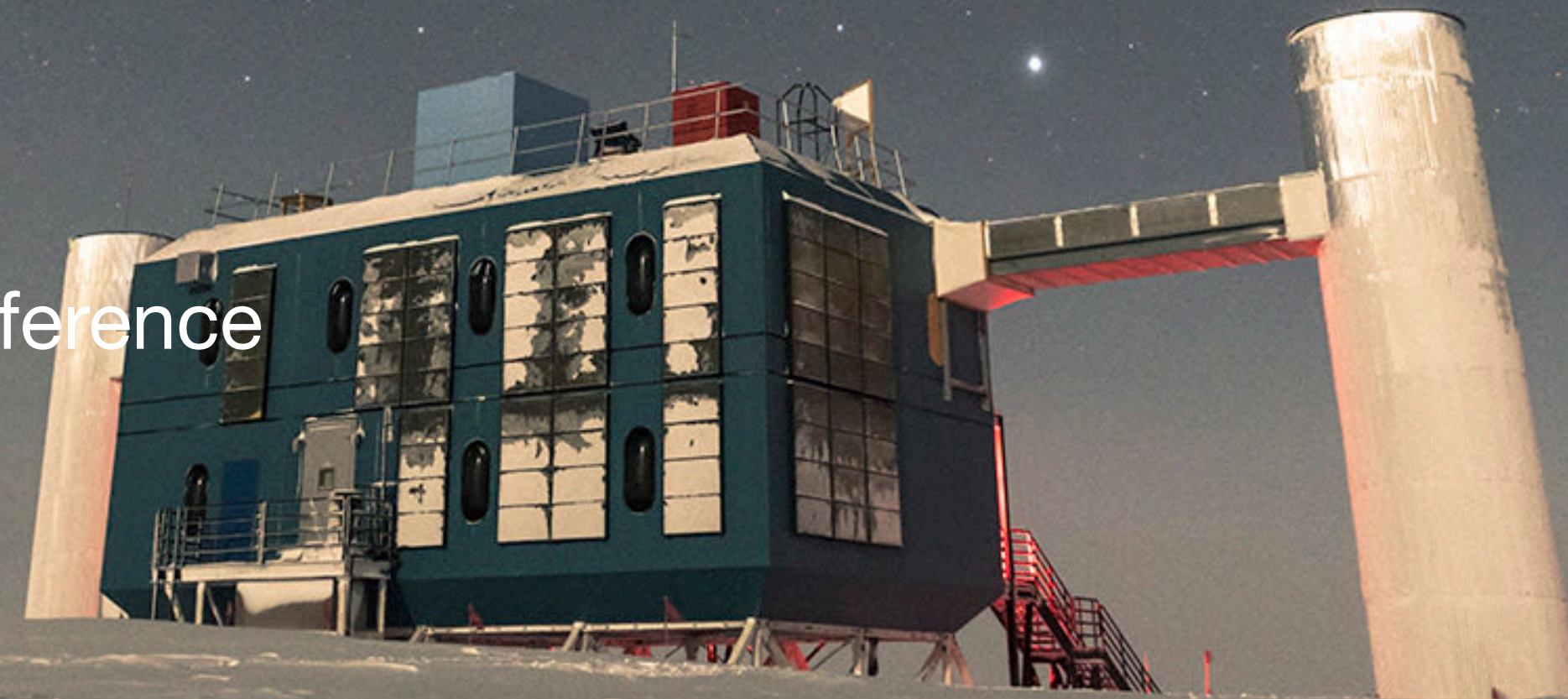
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Introduction

- Dark matter (DM) decaying into Standard Model particles

  ‣ Neutrinos produced by the decay, or through the subsequent decay of the particles.

- High-energy astrophysical neutrinos observed at IceCube, allowing us to test heavy decaying DM hypotheses

- Galaxy clusters and galaxies used as targets

- Considering 10 TeV $< m_{DM} <$ 10 PeV

- Using track-like events recorded between 2012 and 2018

Analysis Methods

- Signal :
$$\frac{d\Phi_\nu}{d\Omega dE_\nu}(\hat{n}, E_\nu) = \frac{1}{4\pi m_{DM}\tau_{DM}}\frac{dN_\nu}{dE_\nu}(E_\nu)\int_0^\infty \rho_{DM}(l\hat{n})dl$$

  dN_ν/dE_ν obtained by simulating DM decay into a pair of Standard Model particles (with 100% BR).

- Source intensity proportional to the D-factor

$$D = \int_0^{\Delta\Omega} d\Omega \int_0^\infty \rho_{DM}(l\hat{n})dl$$

- Sources with large D-factors selected
  - ‣ 3 galaxy clusters, 7 dwarf galaxies, and the Andromeda galaxy (M31)

- Background estimated using experiment data.

- An Unbinned maximum likelihood analysis performed

Neutrino spectra at the Earth

Locations of the targets in the sky
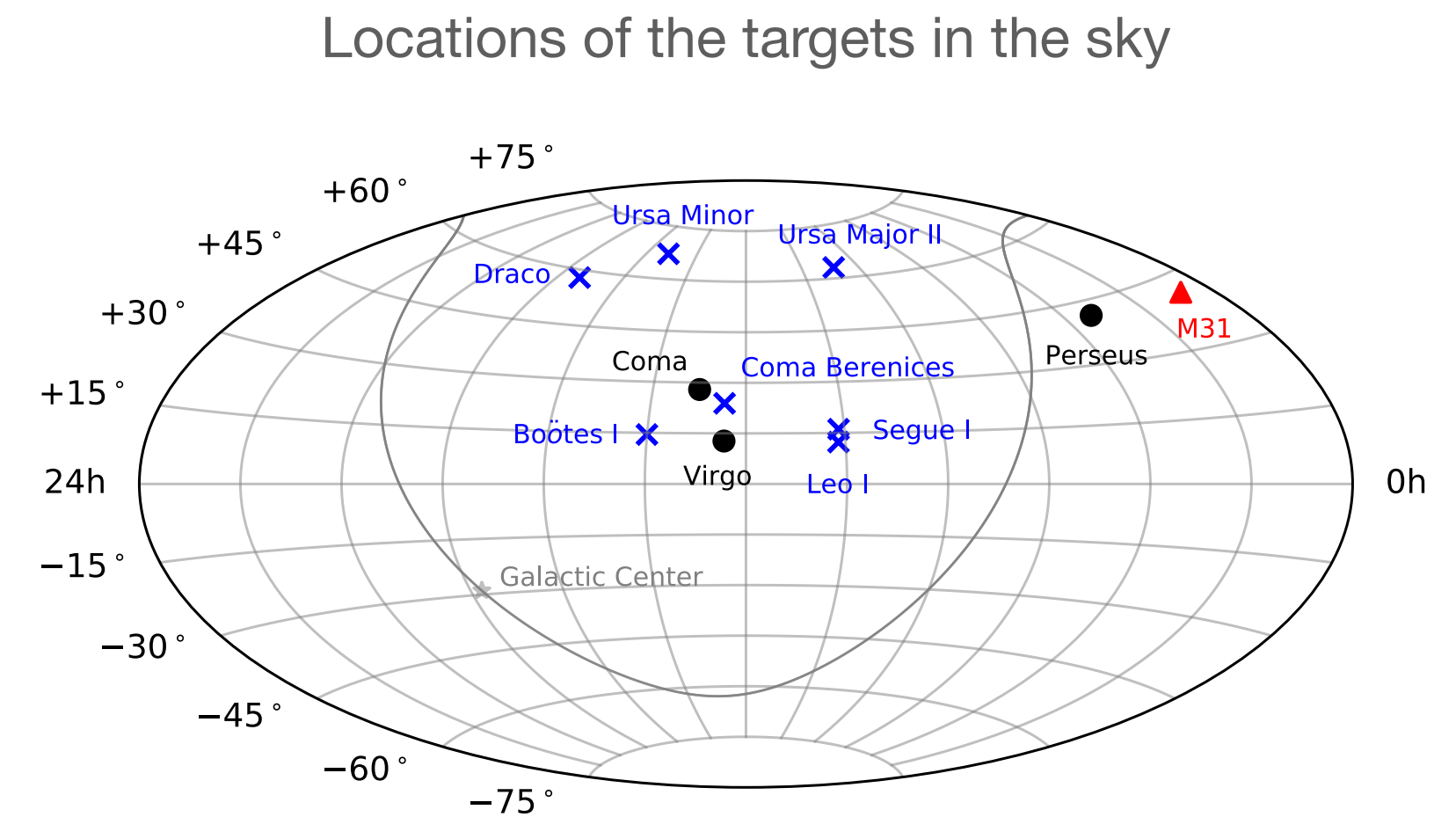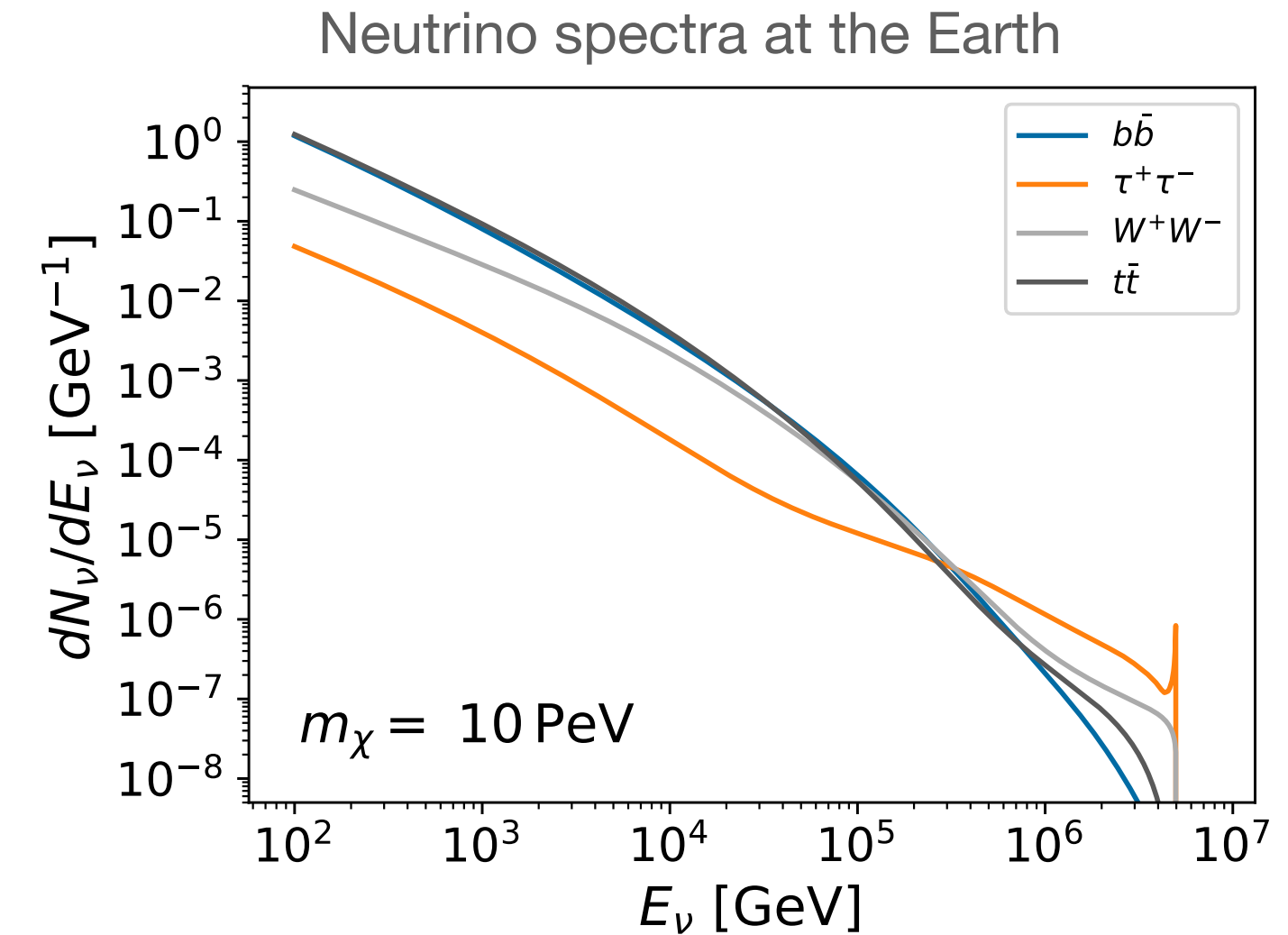
(The Galactic Center and Galactic Plane are shown only for references.)

Sensitivities of the analysis

Sensitivities calculated for individual sources and for stacking

dashed line : sensitivities for the Andromeda galaxy

solid line : experimental limits from recent decaying dark matter searches

The sensitivities competitive with the experiments