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Resolving the Geometry of Off-Axis Gamma-Ray Burst Jets

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Merging neutron stars (and most likely also black hole-neutron star mergers) emit gravitational waves (GW) and electromagnetic radiation. These mergers are followed by the launching of ultra-relativistic jets that presumably produce a short gamma-ray burst GRB that we detect across the entire EM spectrum. The geometry of these jets is of special interest. Their observing angle can significantly improve the accuracy of the measurement of H0 using GW, while the jet core angle is related to its total energy, propagation, and the launching mechanism. A unique property of mergers detected by their GW signal (unlike those detected by their GRB emission) is that they are nearby, and the jets are seen off-axis (i.e., pointing away from us). This combination opens a special opportunity to measure the system geometry. High-resolution radio observations that can resolve the motion of the GRB afterglow image play a key role in decoding the jet geometry. In my talk, I will present a model for the afterglow image, and a study of the accuracy at which the viewing angle and the jet core angle can be measured from afterglow observations. I will also discuss the potential for resolving the Hubble tension using a small number of optimally observed merger afterglows.

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