Type Ia Supernova Cosmology

Keiichi Maeda IPMU Assistant Professor

The history and content of the Universe can be studied by looking at the size of the Universe as a function of time since the Big Bang. We can convert the distance to an astronomical object to the size of the Universe in each epoch. Standard candles, with which we can estimate intrinsic brightness, play a key role here, since it allows us to measure distance by comparing apparent brightness to intrinsic brightness. Type Ia supernovae are bright and good standard candles. Their intrinsic brightness can be estimated by the simple relation that brighter supernovae decline more slowly (Figure). It was type Ia supernovae that led to the 1998-1999 discovery that the Universe mainly comprises dark energy. However, individual supernovae show disparities in brightness beyond the estimate using the decline rate, introducing the error in distance measurement. The origin of these disparities has not been identified. Once we understand this origin, the accuracy of distance measurement will be greatly improved. This is an important step in identifying the properties of dark energy.