

---

# Synthetic Rotation Curves of Spiral and Irregular Galaxies: PCA Approach

Myung-Hyun Rhee

Kapteyn Astronomical Institute, The Netherlands &  
Dept. of Astronomy, Yonsei University

We analyse the shape of the rotation curves by means of the Principal Component Analysis (PCA) and find that the first two principal components account for about 90% of the total variance in rotation curve shapes. The most important physical parameter (the first principal component) works for the rotation curve in a similar way at all positions within galaxies. The second principal component mainly determines the changes of the central rotation curve. We have compared the first and second principal components with the physical properties of the sample of galaxies and found that the first principal component is clearly related to the size parameters like the luminous mass of the galaxy. We have also shown that the second principal component is most likely related to the luminous mass density. We conclude that the first two principal components largely determine the shape of the rotation curve. We have constructed synthetic rotation curves based on the principal components. We argue that the synthetic rotation curves constructed in this way have many advantages over the conventional ways of describing the shape of the rotation curve: more objective, comprehensive and widely applicable.