V838 Monocerotis

Background:

In January, 2002, a previously unremarkable star suddenly became several thousand times brighter. After two more outbursts in February and March, it has been dimming ever since. Observations taken periodically since the initial 2002 outburst have revealed that this star (V838 Monocerotis, or V838 Mon for short) is not a typical nova. Indeed, it is unclear exactly what V838 Mon is and where it falls into our picture of stellar evolution. The shells of dust surrounding the star are not the result of V838 Mon expelling matter, but rather circumstellar dust being illuminated by a light-echo.

The light echo of V838 Mon was unprecedented, but its physics is fairly well understood. A light echo results from light from the progenitor star reflecting off circumstellar dust and gas. This reflection increases the light's path length, so it lags behind the starlight travelling directly to Earth. As a result, what appears to be an expanding shell of debris is really light from the outbursts expanding ever outward.

It is important to note that the light echo does not simply expand spherically about the progenitor star. The echo surface is an ellipsoid with V838 Mon at one focus and Earth at the other, given by the equation;

$$z = x^2/2ct - ct/2$$

This odd geometry means that we cannot use the expansion rate of the light echo to estimate a distance to the system, but we can use the distance to V838 Mon to get an apparent expansion rate of the light echo. The result is a little strange!

Purpose:

In this lab, you will use HLA images of V838 Mon taken at different times to calculate the apparent expansion rate of the light echo.

Things you will need to get:

At least 2 ACS/WFC images of V838 Mon (Hubble Legacy Archive)

Distance to V838 Mon (see Sparks et al. 2008)

Hint:

The plate scale of ACS/WFC drizzled images is the same as the ACS/WFC camera: 0.05”/pixel