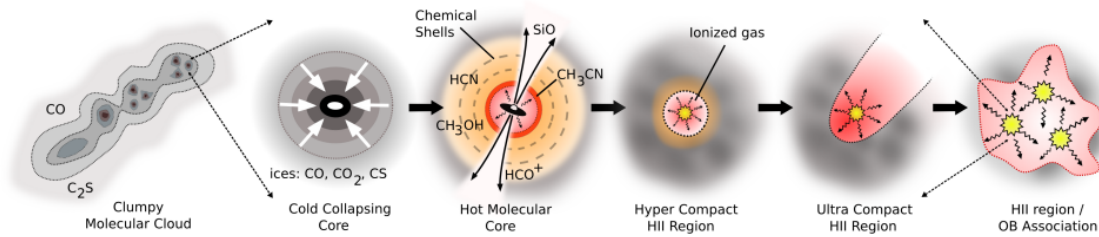


Understanding the light curves of periodic methanol masers



Project level: Honours

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Background: It is now 23 years since the discovery of the first periodic methanol maser associated with a high-mass star-forming (hmsf) region. At present about 30 hmsf regions are known to have associated periodic methanol masers. Although various proposals have been made for the underlying mechanisms responsible for the periodic behaviour, no conclusive observational confirmation for any of the proposals has been presented. The light curves of the known periodic masers have a variety of shapes. Some of the light curves have a flare-like shape where the maser flux density rapidly increases from a quiescent level followed by a slow decay to return to the quiescent state. Others have light curves that resemble the optical light curves of some classical Cepheids and Mira variables. Since the light curve carries information about the underlying mechanism responsible for the periodic behaviour, it is important to characterise the light curves of as many periodic masers as possible. It is suspected that the shape of the light curve might be related to the evolutionary state of the young high mass star. The figure below shows an example of the light curve of the periodic 6.7 GHz methanol masers associated with the high-mass star-forming region G338.935-0.062 and the results of some model calculations.

Project statement: In this project the student will analyse the light curves of selected periodic methanol masers which are monitored with the HartRAO 26m telescope. The process includes a critical evaluation of the time series data to remove outliers and other bad data points, followed by a periodic analysis, folding of the data and characterization of the waveform. We are particularly interested in characterizing the differences in the waveforms of those periodic masers for which the light curve suggests that the periodicity is driven through the pulsation of the young star.

Recommended skills and interests: The data analysis will be done using Python. The student will become familiar with methods used to analyse time-series data which are applicable in many fields of astronomy. The student will also learn about maser theory, the current theories of high-mass star formation and how it may affect the light curves of periodic masers.

