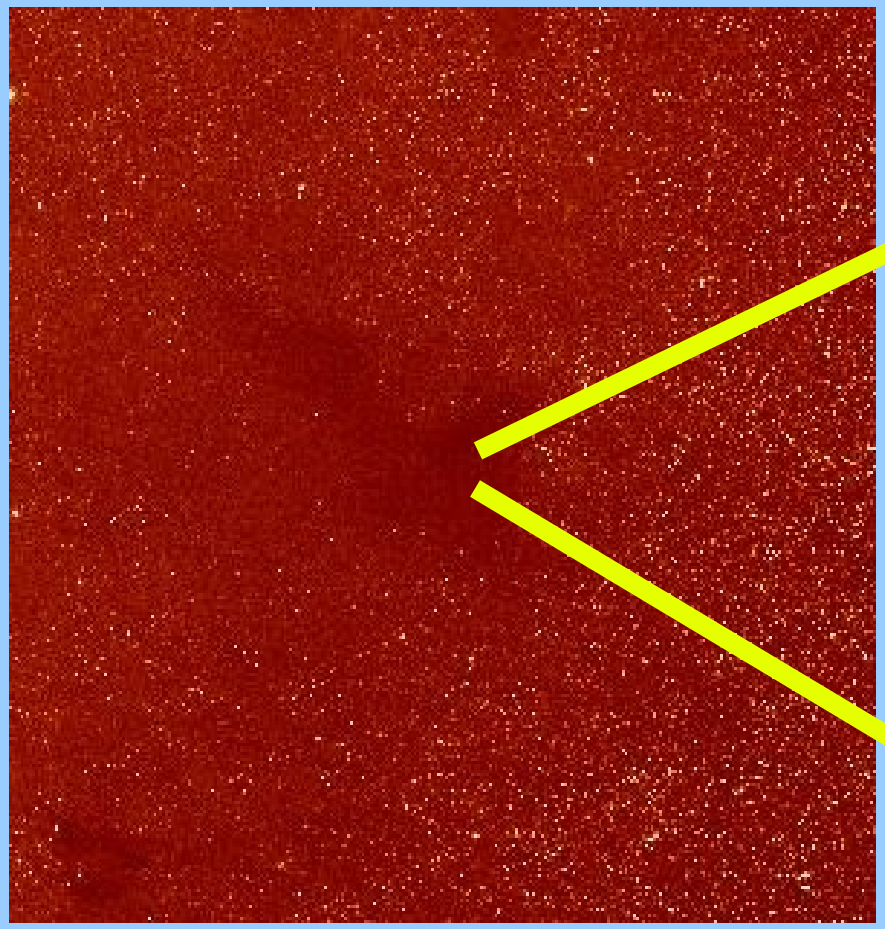
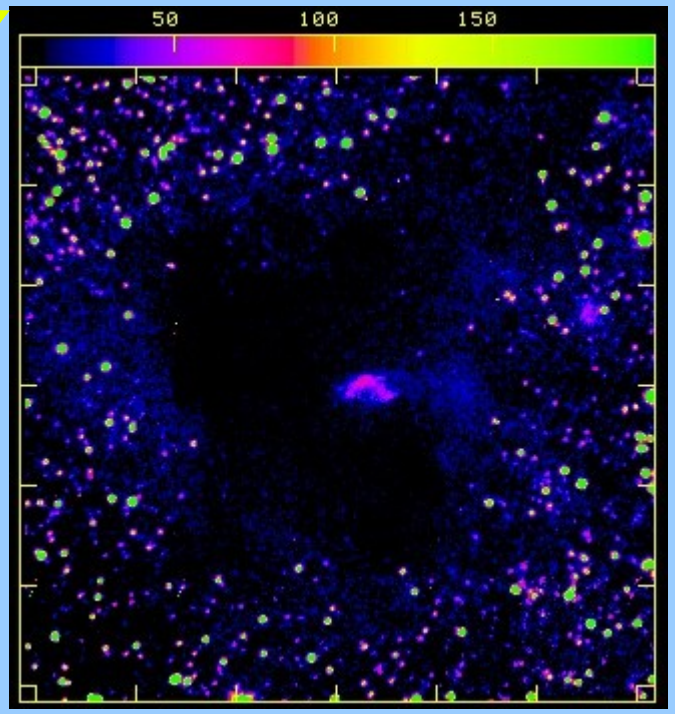
Star Formation Research In The Astrophysics Group

The dust in nearby interstellar cloud blocks out the optical light from background stars.



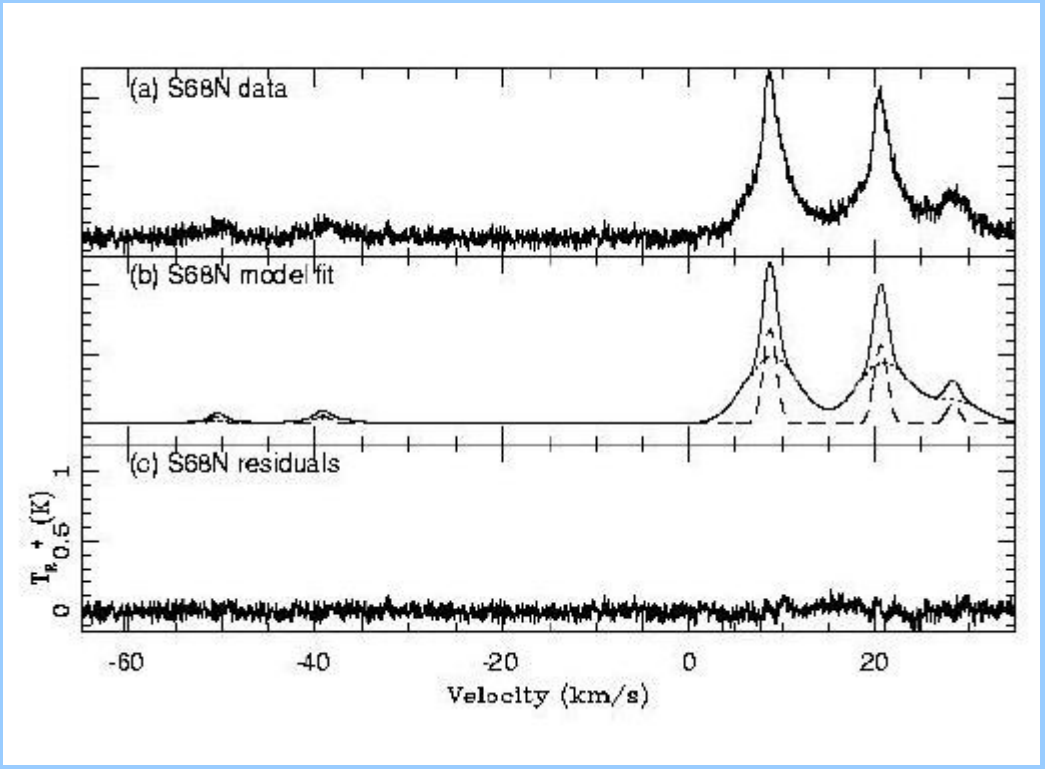
Optical image of a nearby cloud which can be seen as the large region devoid of stars.

But near infrared wavelengths the dust becomes more transparent and young stars forming in the clouds become visible



More stars are visible in this near infrared image and an arc of emission associated with the supersonic outflow of material driven by a star forming in the cloud is now visible.

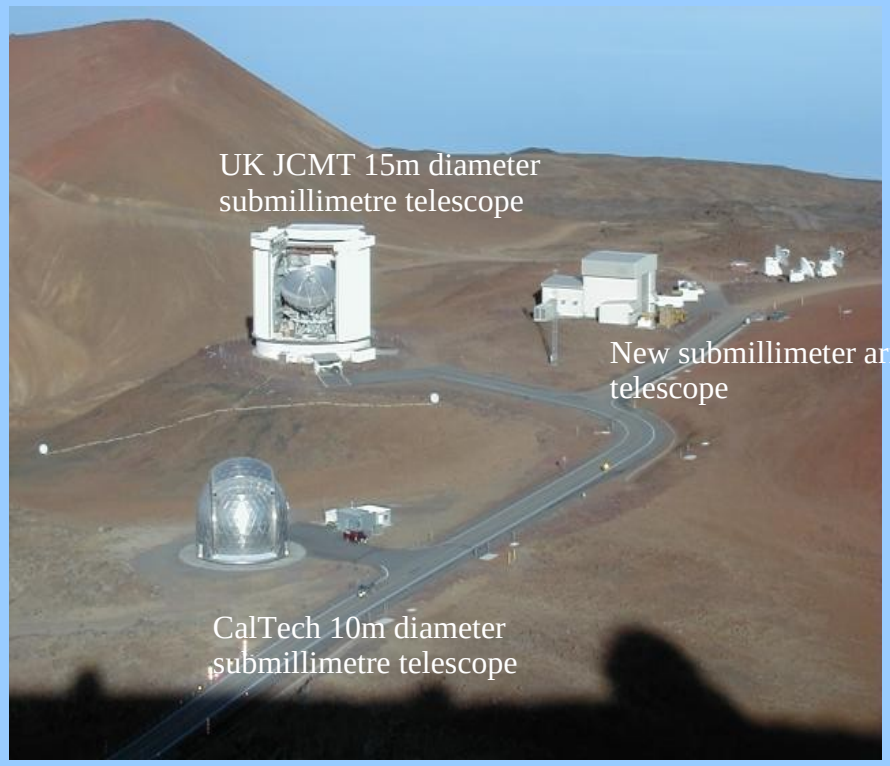
The dust in these clouds is only a minor constitutent. Most of the mass is in the form of cold molecular gas. This gas has a temperature of only a few tens of Kelvin above absolute zero. The clouds are mostly molecular hydrogen but over 100 different molecules have been detected in these clouds, including water, silicon dioxide, sulphur dioxide, ammonia, ethanol and methanol. Carbon monoxide is the second most abundant molecule and one which is often observed.

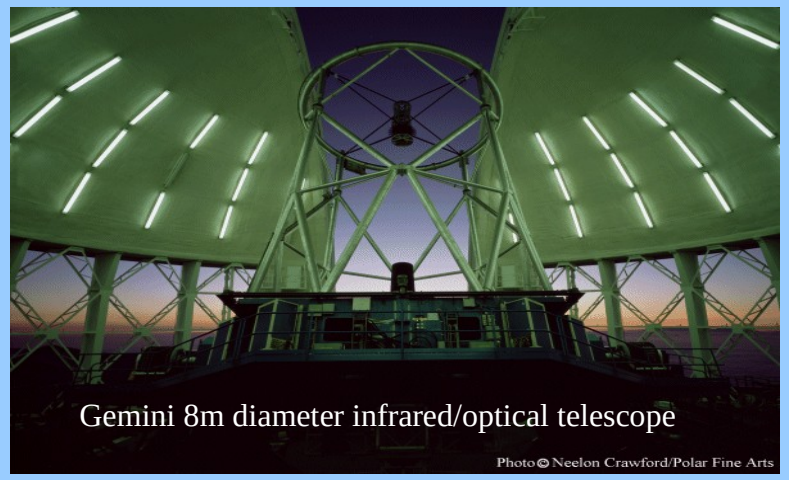


Spectrum of methanol towards a protostar (top) and model used to quantify the emission. The width of the line contains important information how the gas is moving close to the protostar.

These data are part of a UMIST students Ph.D. thesis and was taken with a telescope in Arizona, USA.

Some of the telescopes used to observe near infrared and molecular line emission.





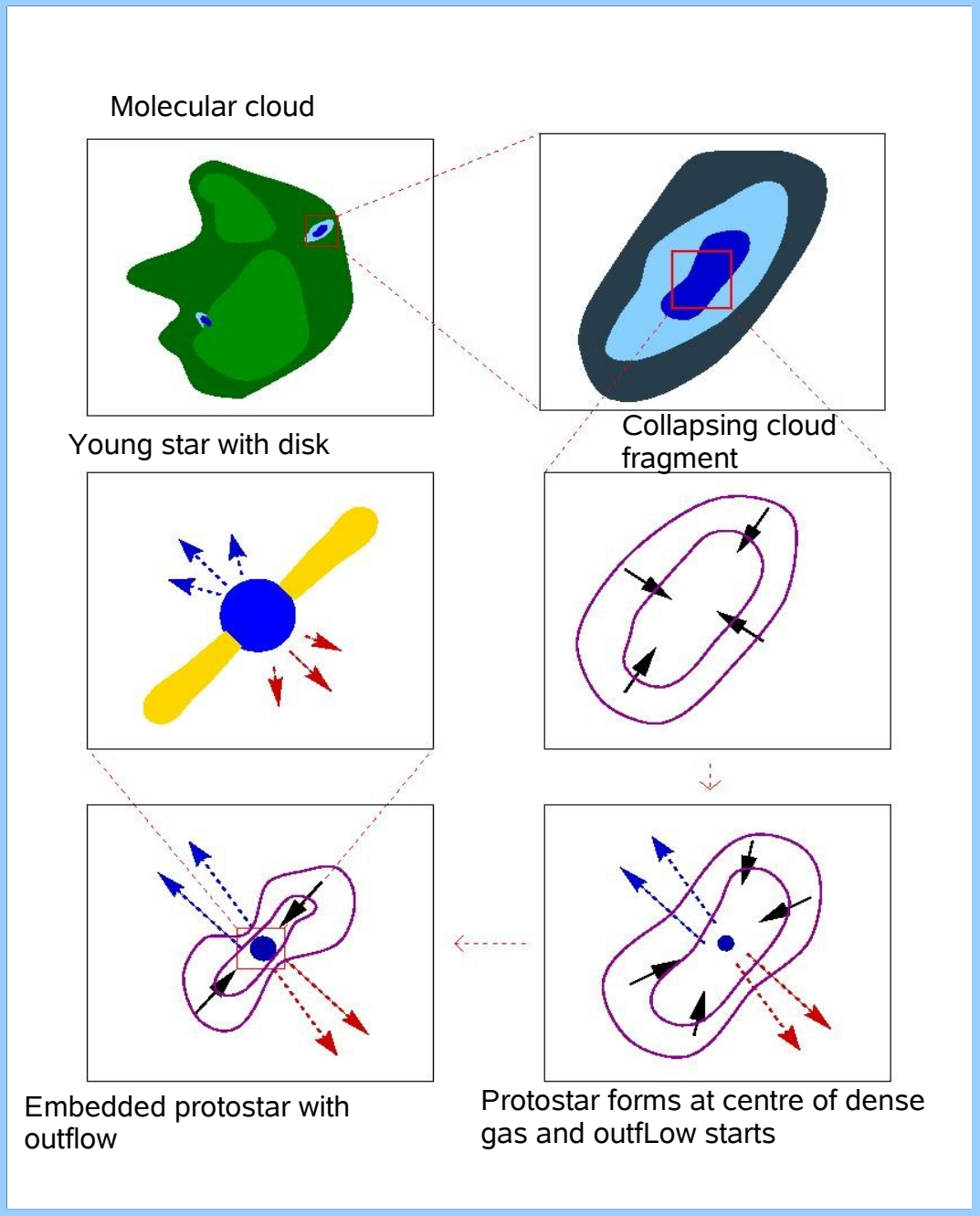
All these telescopes are on the 4300m (14,000 foot) summit of the extinct volcano Mauna Kea in Hawaii.

Star Formation

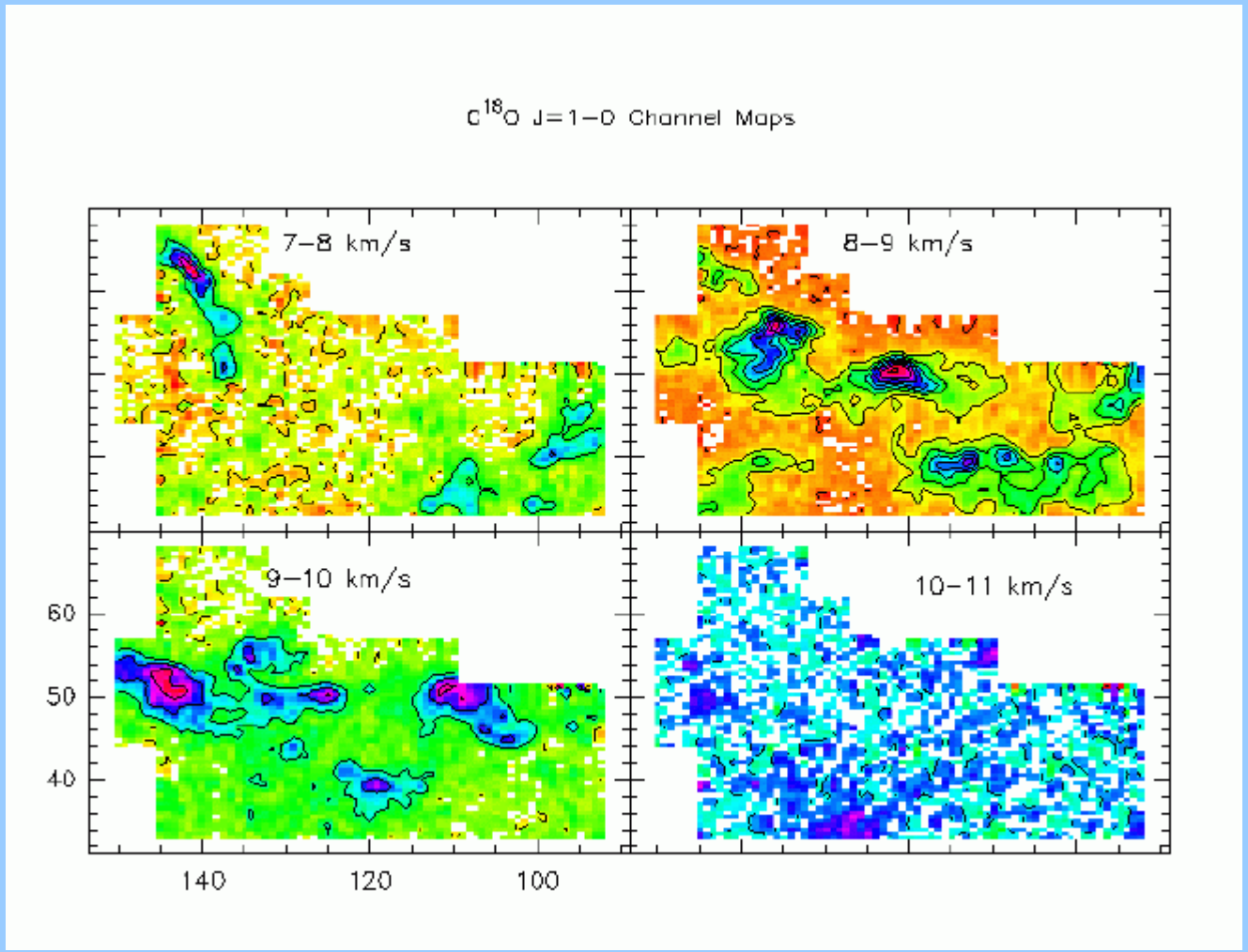
When parts of a cloud become sufficiently massive, they collapse to form a young star, a protostar. These protostars are surrounded by disks of gas and dust in which planets may form. In these early stages the protostars also drive massive and energetic outflows which can blow away the remaining cloud material.

This protostar stage lasts for only about 100,000 years. A star with the mass of our sun will live for 10 billion (10^{10}) years in all.

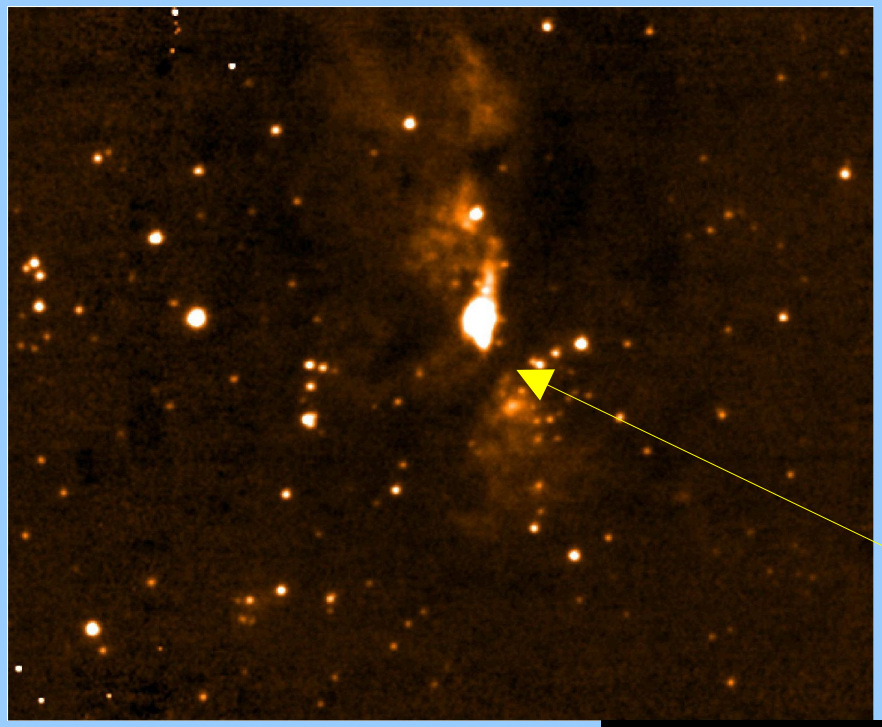
A cartoon view of Star Formation



A Molecular Cloud



This region of a molecular cloud shows several dense clumps of gas which over the next 100,000 years may collapse to form more stars. The properties of these clumps such as their size, density, temperature, chemistry and angular momentum tell us the initial conditions for star formation. We measure these properties through their emission in various molecules such as CO, NH_3 (ammonia) and CH_3OH (methanol).

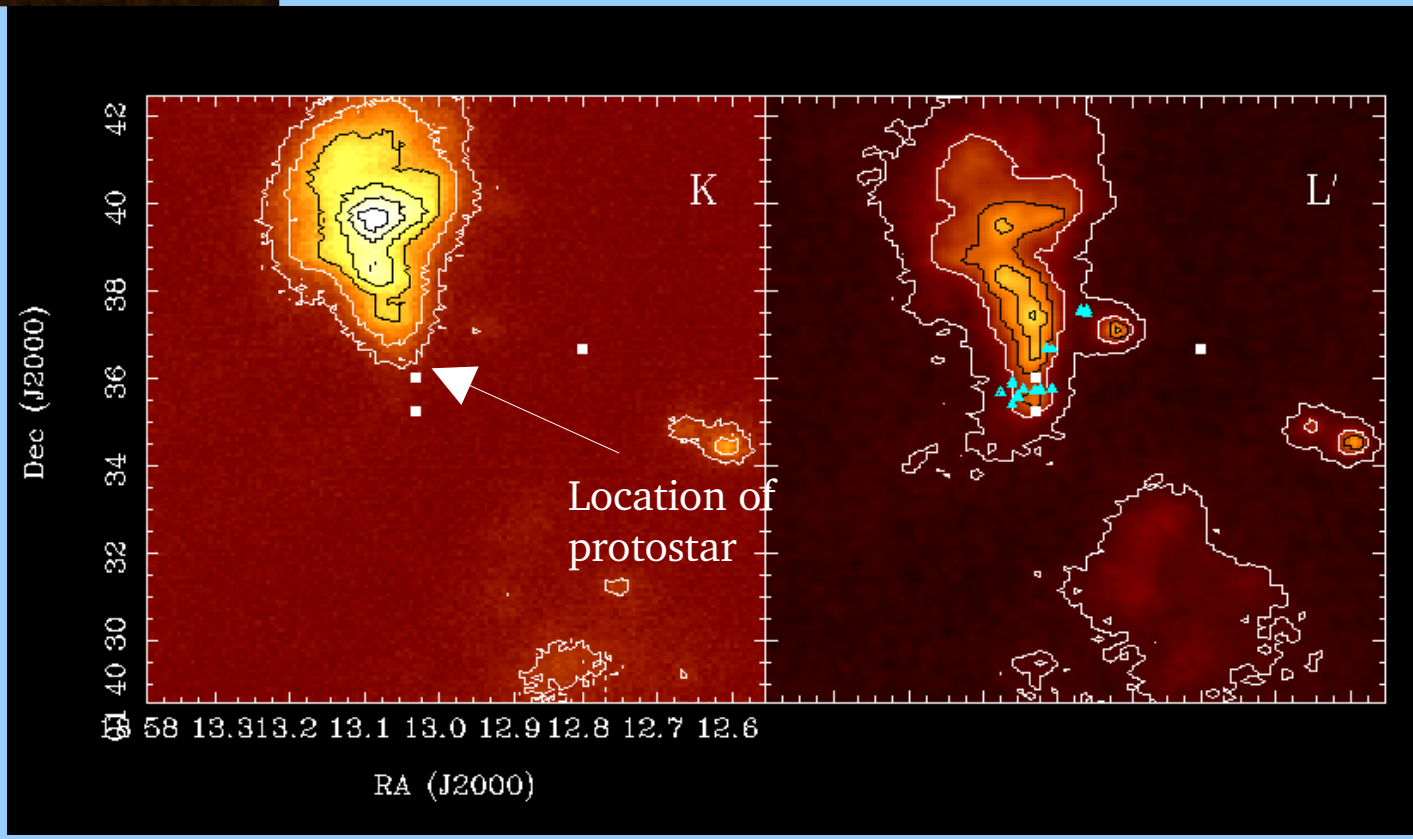


The birth of a High Mass Star

These infrared images show an example of a very young star about 7 times more massive than our sun.

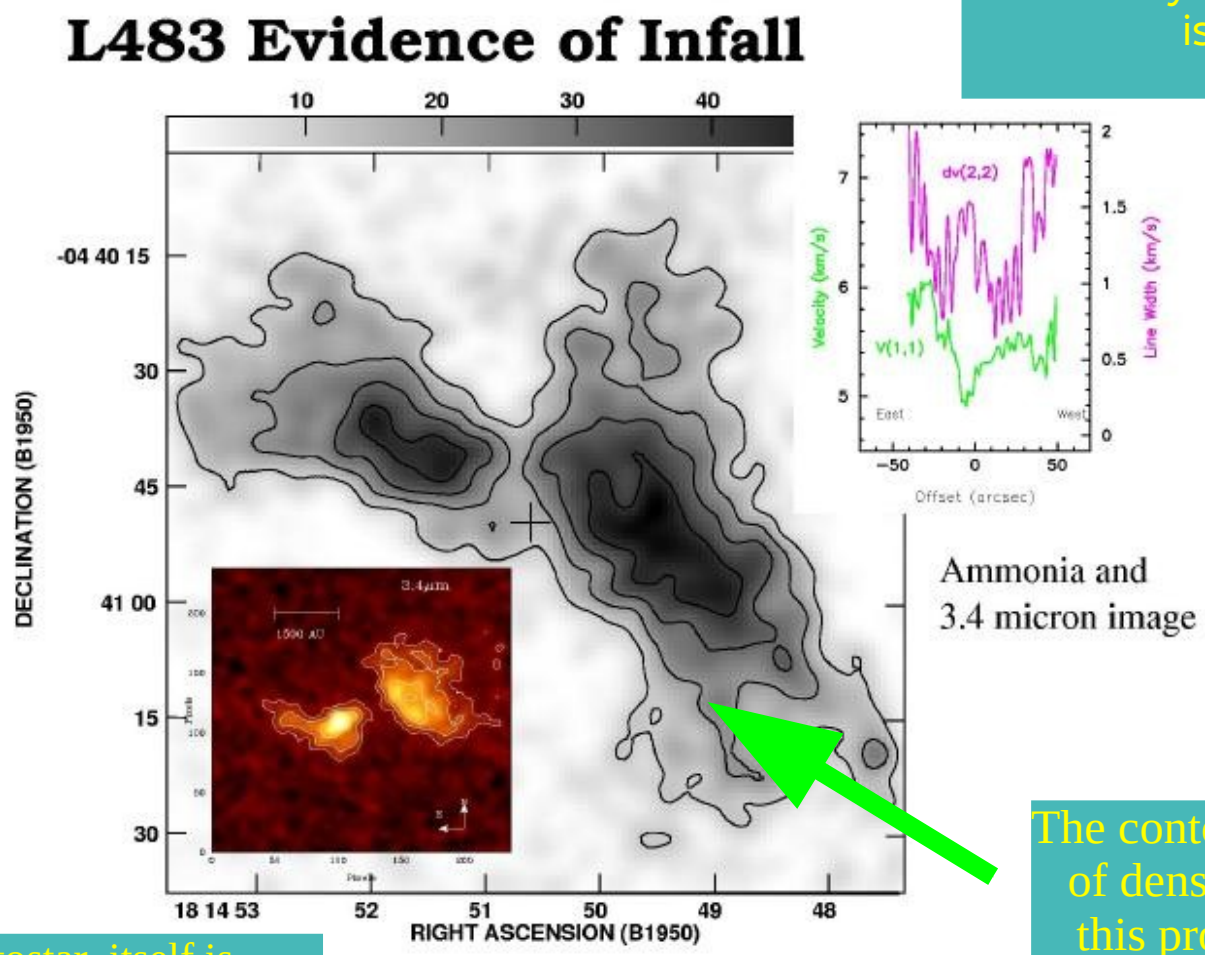
The image to the left shows the large nebula illuminated by the protostar. The protostar itself is hidden in the dark dust lane indicated.

The images to the right show enlargements of the central region of the cloud at two different infrared wavelengths. The white squares show the location of radio sources and the blue triangles show hydroxl masers. The group near the radio source trace the circumstellar disk around the protostar.



A Low Mass Protostar

The velocity of the gas shows that it is collapsing



Ammonia and 3.4 micron image

The contours shows the ridge of dense gas out of which this protostar is forming

The protostar itself is hidden behind its circumstellar disk

More Information

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