Detecting the water snowline in protoplanetary disks

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My PhD project consists of measuring the position of the water *snowline* in protoplanetary disks by means of chemical species that anticorrelate with the presence of gaseous water in disks.

A protoplanetary disk is a rotating circumstellar disk of dense gas and dust surrounding a newly formed star. The disk itself is formed to conserve the initial angular momentum of the natal molecular cloud. Mass is transferred from the disk to the central star. At the same time, planet formation takes place inside the disk.

The central star regulates the thermodynamics of gas and dust in disks, giving origin to a radial temperature gradient. The region in the disk where the temperature falls below the condensation temperature of water (T ~ 150 K) is referred to as the *snowline*, that is the location of the condensation front. In the inner, hotter, disk region – inward of the *snowline* - water is present in the gaseous phase, while outward of the *snowline* - in the outer, colder disk - water is found frozen onto dust grains.

The snowline position is important for setting the bulk composition of planets. For a typical solar-type star the water snowline is situated at around ~ 1 – 5 au from the star. Inside this radius planets will be formed from “dry-grains”; outside the snowline instead, planets will accrete from ice-rich planetesimals. This dichotomy will have an impact on the planetary composition.

My PhD project consists of two steps: in the first step, I will work on computational models aimed at finding potential molecular species that trace the snowline. The basic concept is to search for molecules that anticorrelates with the presence of gaseous water. For this, I will use the thermo-chemical code ProDiMo (Woitke et al. 2009). Based on the model predictions, in the second step , I will apply for telescope time with ALMA (Atacama Large Millimeter Array working in the sub-millimeter range) to detect and spatially resolve the emission of the snowline tracers in a set of well studied sources.