An average star formation rate for the Central Molecular Zone

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The central molecular zone (CMZ), the central 500 pc of our Galaxy, represents an exceptional environment. This region produces around 5-10 % of the infrared luminosity of the Galaxy and contains ca. 10 % of its neutral gas (e.g. Güsten 1989). Temperature, velocity dispersion, and magnetic field strengths are much higher than in the Galactic Disk (Morris & Serabyn 1996). A study of the young stellar objects (YSOs) in the CMZ can help to determine the influence of extreme conditions on star formation.

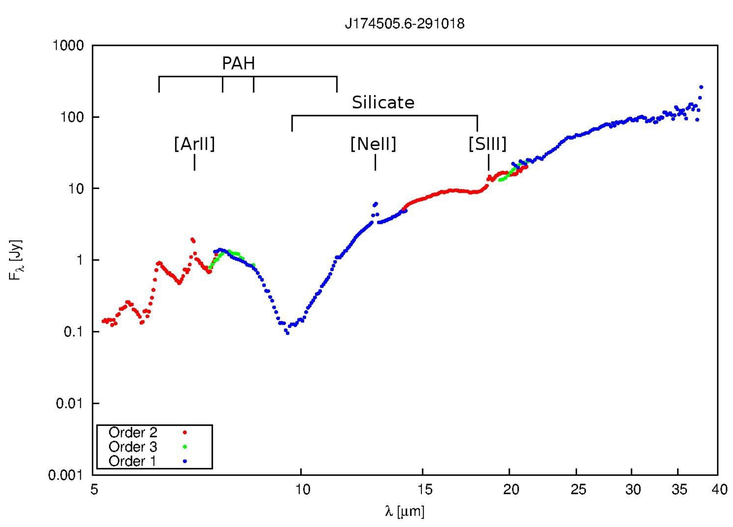
Test Sample

A sample of 68 Infrared Space Observatory (ISOGAL) point sources within a 0.1 deg^2 region near the Galactic Center and with [15] < 5.25 mag and [7]-[15] > 1.8 mag was selected for a spectroscopical confirmation of **selection criteria which are based on the [7]-[15] ISOGAL color as well as the spatial extension of the sources at 15 µm (Schuller et al. 2006).**
In March 2005, spectroscopic data of the test sample were obtained in mapping-mode with the two low-resolution modules of the Infrared Spectrograph, on-board the Spitzer Space Telescope.

CMZ Sample

In the 1990s, the Galactic plane was observed by two mid-infrared surveys conducted with Midcourse Space Experiment (MSX) at 8, 12, 15 and 21 µm (Price et al. 2001) and with ISOGAL at 7 and 15 µm (Omont et al. 2003).
Refined selection criteria similar to those of Schuller et al. (2006) were applied to all ISOGAL sources in the CMZ, selecting 485 ISOGAL sources with [15] < 5.25 mag. We added 656 MSX sources with $F_E/F_D > 2$ (Schuller et al. 2006) without an ISOGAL counterpart. **In total, our CMZ sample contains 1141 young object candidates.**

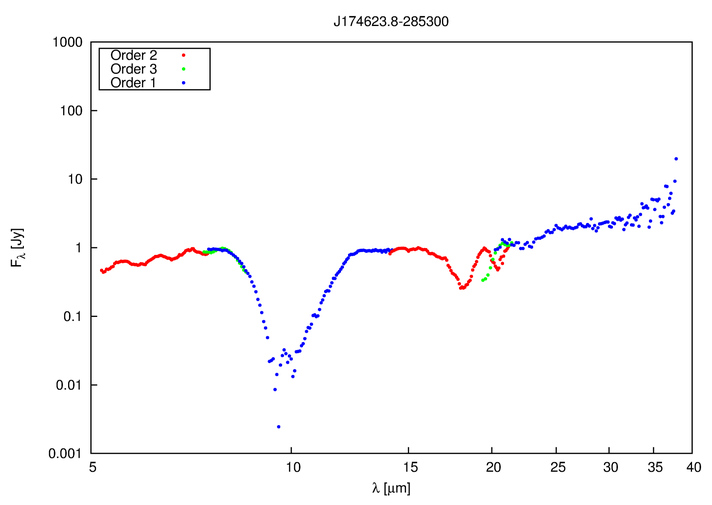
Young Object



Spectroscopic Properties of the Test Sample

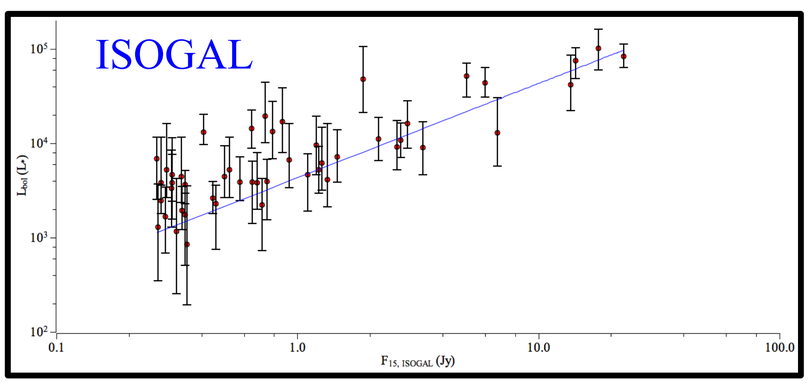
Based on the spectral features and the slope of their continua, we classified our test sample sources as young objects (young stellar objects or HII regions) or late-type evolved objects. The most common features in our spectra are silicate absorption bands at 9.8, 18 and/or 23 µm, forbidden fine structure emission lines from ionized species ([ArII] (6.97 µm), [NeII] (12.83 µm), and [SIII] (18.7 µm)), and emission features from polycyclic aromatic hydrocarbons (PAHs).

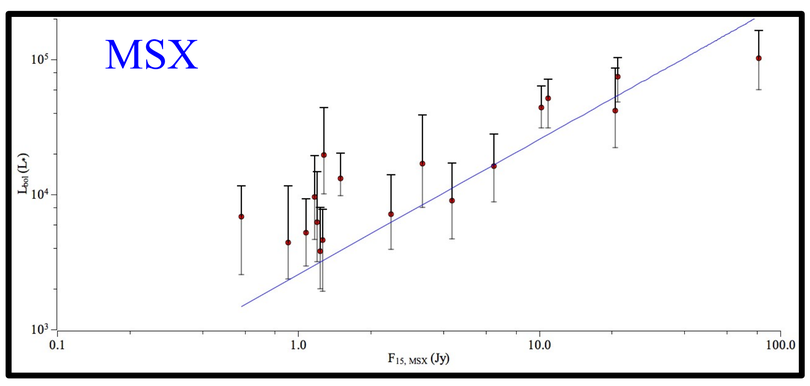
Evolved Stellar Object

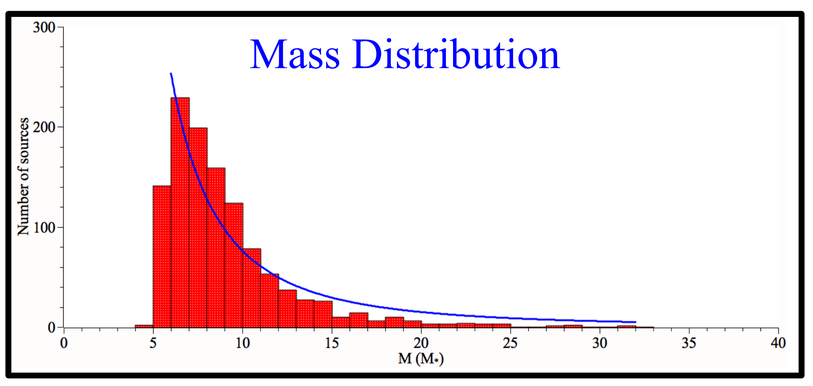


Star Formation in the Central Molecular Zone

The test sample sources with a steep rising continuum were fitted with the SED fitting tool of Robitaille et al. (2007). From the results, we obtained bolometric luminosities L_{bol}, assuming a distance of 8.0 kpc to these sources (Reid et al. 2009). Then, we derived a linear relationship between L_{bol} and the extinction-corrected ISOGAL and MSX flux densities at 15 µm F_{15}. For all sources in our CMZ sample, we obtained bolometric luminosities from the L_{bol}/F_{15} conversion factors and masses for the central object, assuming that the bolometric luminosity is that of a zero age main sequence star. The distribution of the masses follows roughly a Salpeter IMF, but showing that very massive stars and low-mass stars are missing from the CMZ sample due to saturation effects and the selection criterium [15] < 5.25 mag, respectively.
Interpolating a modified Salpeter IMF down to 0.08 $M_\odot$, we obtained a total mass in young stellar objects of ~75500 $M_\odot$. Since the detection as bright mid-infrared sources requires that the sources are still deeply embedded in their dust cocoon, the sources still have to be very young. **Assuming a formation time of 1 Myr (lifetime during which the star is still deeply embedded in its birth cloud), our results yield a star formation rate of 0.08 $M_\odot$/yr for the Central Molecular Zone, consistent with previous studies.**







References
Güsten 1989, in IAU Symposium, Vol. 136; Morris & Serabyn 1996, ARA&A, 34, 645; Omont et al. 2003, A&A, 403, 975; Price et al. 2001, AJ, 121, 2819; Reid et al. 2009, ApJ, 705, 1548; Robitaille et al. 2007, ApJS, 169, 328, Schuller et al. 2006, A&A, 453, 535