

# PROBLEM STATEMENT

Literally everything except primordial hydrogen and helium comes ultimately from stars. Studying nearby dwarf galaxies provides us the opportunity to learn how the first generation of stars formed 13 Gyr ago.



Figure 1: Left: Blue compact dwarf galaxy I Zw 18 and companion. I Zw 18 has one of the lowest recorded abundances of heavy elements. Right: Stephan's Quintet, a compact galaxy group that may soon form new dwarf galaxies.

#### BACKGROUND

Dwarf galaxies typically form stars at a rate much lower than more massive galaxies (such as our own Milky Way). This means their interstellar medium (ISM) is less contaminated by heavy elements (anything with an atomic number > 2). By observing the properties of the cool ISM we can learn more about how stars form under conditions similar to what existed everywhere in the Universe shortly after the Big Bang. Stars form in giant molecular clouds composed mainly of  $H_2$ , a molecule with no observable spectral lines. Therefore star formation studies use observations of CO, which has multiple spectral lines in mm and submm frequency ranges. Because dwarf galaxies are underabundant in both C and O, making such observations is extremely challenging.

## Dwarf Galaxies, the Universe, and Everything Chris Taylor, Department of Physics and Astronomy College of Natural Sciences & Mathematics



## SUMMARY OF WORK

My work has primarily consisted of pushing the detections of molecular gas clouds to increasingly lower heavy element abundance, to probe the very environments that closely resemble the early Universe (Figure 2). Once we achieve detections, my collaborators and I follow up with high resolution interferometric observations to measure the properties of the molecular clouds (Figure 3).



#### Figure 2: CO intensity vs. O abundance, Taylor et al. 1998.

IMPACT ON COMMUNITY

There is no more fundamental question than: Where do we *come from?* The answer to this question is: From stars.

The study of the formation of stars fills in the details of how molecular gas clouds lead to stars, planets, and eventually US.









#### Figure 3: Molecular gas emission in Stephan's Quintet. Taylor et al. 2005