Large planets are more abundant around metal-rich stars\cite{1,2,3}, but there is a debate on whether this trend applies to small planets.

We selected 1166 multi-planet candidates around 650 stars from the Kepler mission\cite{3,4,5} and divided them into 6 sub-regions on the [Fe/H]-R_p plane. We calculated the fraction of stars with planets in each sub-region, which gives the relative planet occurrence rate of metal-rich and metal-poor stars.

Here is the result! Gas giant planets are 2.6 times more abundant around metal-rich stars than metal-poor stars. Neptune-like planets are 1.4 times more abundant around metal-rich stars, but the planet occurrence rate for small-radii planets is not dependent on stellar metallicity.

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{The detection incompleteness (excluding geometric effect) is low for gas giant planets and Neptune-like planets. The incompleteness is non-negligible for small-radii planets, but we expect the incompleteness similarly affects the metal-rich and metal-poor samples. Therefore, the ratio of the fraction of stars with planets is the relative planet occurrence rate between metal-rich and metal-poor stars.}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure2.png}
\caption{We found a planet-metallicity correlation for Neptune-like planets which previous studies have not found. One possible explanation is previous studies considered small planets with R_p < 4 R_Earth, which results in a mixture of Neptune-like planets and small-radii planets. A dilution/cancelling effect would be induced if the Neptune-like planet occurrence rate is metallicity-dependent and the small-radii planet occurrence rate is not.}
\end{figure}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure3.png}
\caption{Small-radii planets may be more abundant around metal-poor stars, i.e., there may be a negative planet-metallicity correlation for small-radii planets. Small-radii planets are more difficult to find around metal-poor stars because these stars are in general more distant, brighter and larger. The higher incompleteness for small-radii planets around metal-poor stars than metal-rich stars may suggest that small-radii planets are intrinsically more abundant around metal-poor stars.}
\end{figure}