Electronic structure of pure electron liquid in crystallizing process

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When the strongly correlated system system undergoes metal-insulator transtion (MIT), many intriguing phases emerge as an intermediate phase such as unconventional superconductivity which sets in between the Mott insulating phase and metallic phase of tirival Fermi liquid phase. Focusing on the electron only, MIT can be viewed as a crystallication of electon – losing the itinerant nature of metallic phase through electron correlation and finally locallized in a decrete position in space. Such crystallization of electrons in solid through the electron correlation is analogically intendtical to the crysatllization of pure electron, a Wigner crystal. Therefore, crystallizing process of pure electron liquid in free space mimics the core physics of MIT in solid, including emergence of the intermediate phases such as stripe, nematic and even superconductivity. This resemblence suggests that studying the crystallization of pure electron system should be highly informative in understaing MIT in solid.

In this talk, I will introduce the electronic structure of pure electron system in crystllizing process, revealed by angle resolved photoemission spectroscopy directly. Starting from inital quanum Fermi liquid phase with simple parabolic band dispersion, we observed the unusual deformation of band dispersion with non-Fermi liquid characteristic, linear energy dependence of scattering late. Further, the electronic structure in non-Fermi liquid phase shows the signature of rotaional symmetry breaking, suggesting the pure electron system is departed from isotropic liquid phase and approached anisotropic liquid crystalline phase, a hexatic phase. With that observation, I will discuss what is the origin of non-Fermi liquid behavior, which is an essence of many intermediate phase of MIT in solid.