Spectroscopy of single quantum levels coupled to a superconductor

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In the talk, I will represent our recent results about scanning tunneling microscopy investigations of nano scale Bi islands on various superconductor substrates, including $NbSe_2$, NbN and $Bi_2Sr_2CaCu_2O_{8+}$ grown by molecular beam epitaxy. It is well known that when the size of a metallic island is reduced to the scale of its Fermi wavelength, energy levels become discrete and quantum dot is thus established. In our material systems, single quantum levels arise in the Bi quantum dots. By coupling to the superconductivity, novel phenomenon such as proximity effect, discrete Andreev bound states and Fano resonance are observed by high resolution scanning tunneling microscopy.