phase approximation (RPA). The paramagnon spectral density function, $\rho_p(x,\omega) = \frac{1}{\pi}\Im\chi^R_\omega(x,x)$, is enhanced in the constriction and grows rapidly while $I_0 = I(\pi\hbar v_F)^{-1}$ approaches 1^- (the mean-field Stoner instability point for homogeneous system). The characteristic energy of the paramagnon mode behaves like $\hbar\omega_{para} \equiv \pi\sqrt{1-I_0}\hbar v_F/L$.

Linear response theory: We examined the conductance in a linear response (Kubo) theory. [7] The DC conductance is obtained using current-current response function.

With a perturbation expansion only including RPA propagator in the lowest order as shown in the Feynman diagrams in Fig.1, we obtained the conductance formula: $G = G_0 \int d\eta(-\frac{\partial f(\eta)}{\partial\eta})(|t_\eta|^2 + \delta\mathcal{T}^a(\eta) + \delta\mathcal{T}^b(\eta))$, where the first term corresponds to the Landauer's formula and the other terms are including χ^R. The first correction $\delta\mathcal{T}^a$ corresponds to the current vertex correction and vanishes at $T = 0$. The second correction $\delta\mathcal{T}^b$ comes from the self-energy of single-particle Green's function. The imaginary part of the self-energy vanishes, however, there is a non-vanishing *positive* contribution at $T = 0$, which is a static potential renomalization.

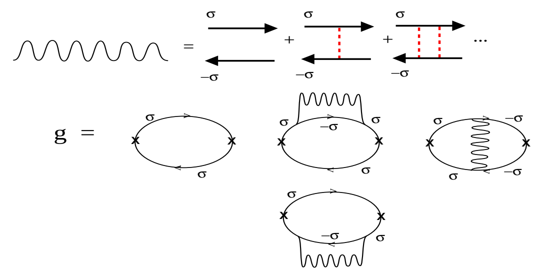

Fig.1 Feynman diagrams in the calculation of the paramagnon propagator (above) and the conductance up to lowest order in the paramagnon propagator. The solid line represents the electron propagater and σ is the electron spin.

The conductance of relatively higher temperatures is described by a model that the electron scattered by the fluctuating potential, $\delta U(x,t)$, which is due to *internal* dynamics (Coulomb interaction). By using the time-dependent perturbation theory [8] for $\delta U(x,t)$ we obtained the stationary current [6] and current noise [9] formula, which explain the experiments well.

Conclusions: We proposed a microscopic theory of electron scattering by spin fluctuations at a constriction in the lowest order perturbation as the origin of the *0.7 anomaly*, which explains successfully the higher temperature behavior. The low temperature and/or non-linear characteristics are interesting, however the lowest-order RPA treatment may not be enough to account for Kondo-like behavior. It would be quite interesting if an electron spin resonance or thermal/shot noise experiment could be done to detect the slow spin fluctuations.

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