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**Sound-wave-like plasmonic excitations in atomic-scale metal chains** T. NAGAO, National Institute for Materials Science, ICORP-JST, C. LIU, S. YAGINUMA, National Institute for Materials Science, T. INAOKA, Iwate Univ., T. NAKAYAMA, National Institute for Materials Science, ICORP-JST — In his pioneering work in 1950, Tomonaga has theoretically proven the existence of a sound-wave like excitation in one-dimensional array of Fermi particles that follows Bose statistics [1]. We have been searching for such one-dimensional (1D) collective excitation in high electron density-limit in atomic-scale metal chains supported on dielectric substrates. Electron energy loss spectroscopy using highly collimated slow electron beam has detected a characteristic sound wave-like excitations that propagate along the wire showing strong anisotropy [2]. These excitations occur in dipole scattering regime and their lifetime rapidly drops as a function of momentum. From these features, the observed losses are identified as one-dimensional collective excitation (plasmon) that Tomonaga has mentioned. These plasmons are highly metallic as judged from their high intensity near the elastic peak, but at low temperatures (<70K), some of the atom wires show reduced density of states which indicates gap opening at the Fermi level, due to Peierls-type metal to insulator transition. [1] S. Tomonaga, Progress of Theoretical Physics Vol. 5, No.4, 544 (1950). [2] T. Nagao, S. Yaginuma, T. Inaoka, S. Sakurai, Phys. Rev. Lett. 97, 116802 (2006).

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