The double-to-single photoionization cross-section ratios of benzene (C₆H₆) have been obtained in the photon energy region between 37 and 180 eV. The measurements were carried out on the 6m-TGM (042) beamline using an ion time-of-flight spectrometer. In a previous experiment we have observed a modulation in the double-to-single photoionization ratio of C₆₀, which could be used to determine the structural dimensions of that molecule [1]. The C₆₀ molecule is a sphere consisting of carbon atoms arranged in pentagons and hexagons. Pure carbon hexagons do not exist in nature, but along with six hydrogen atoms it is the very common molecule benzene. Only very limited information is available on photoionization of benzene over a larger energy range. Double photoionization of benzene has been studied only in the threshold region [2] (first 2 eV). We performed this investigation in order to see whether we can extract structural information from the data as in the case of C₆₀. The double-to-single photoionization ratio curve of benzene reveals indeed a modulation. One local maximum in the ratio can be attributed to the diameter of the benzene ring. However, somewhat surprisingly we can not extract the C-C bond length as in the case of C₆₀. This may be due to the much more delocalized valence electrons in benzene compared to C₆₀. In addition, we obtain a distance that can not be readily assigned to a certain distance of the benzene molecule. Our current hypothesis, which fits well to the data, is that one of the photoemitted electrons bounces inside the benzene ring three times, i.e., is moving in a square, before interacting with the second electron of the double ionization process.

This work was partly supported by the NSF REU program. The SRC is supported by NSF grant No. DMR-0537588.