EXCESS NOISE OF SILICON SURFACE BARRIER DETECTORS OF IONIZED RADIATIONS

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It is known that one of the main factors restricting energy resolution of spectrometric devices is noise of crystal detectors of ionized radiation. Spectral density of current fluctuations of *Au–Si* surface barrier detectors of nuclear radiation was studied. Parameters of fluctuation spectra were compared with the energetic equivalent of noise, that allowed to separate clearly contributions of different noise sources in resolution of the detectors. It was found that at room temperature in frequency range up to 30 kHz the spectral density of current fluctuations is $S_I = AI^n/f^\beta$, where $n = 2 \ldots 3.5$, $\beta = 0.8 \ldots 1.3$ for different samples

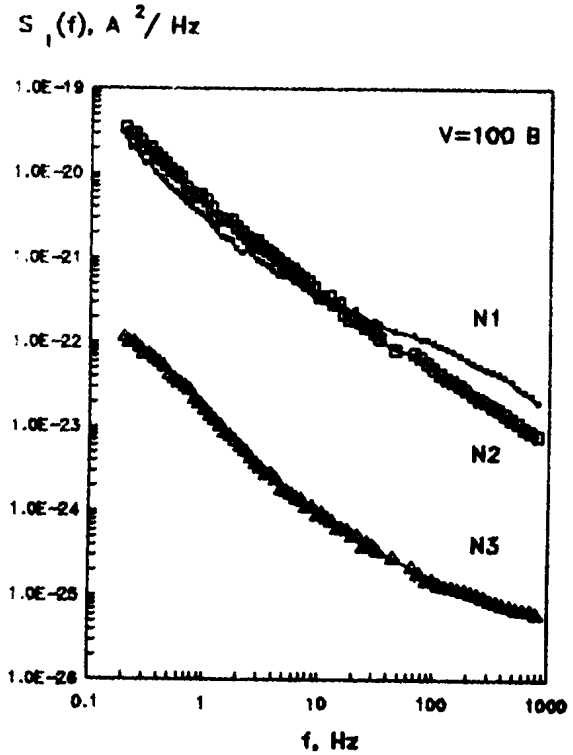

Fig.1. Spectral density of current fluctuations $S_I(f)$ for three detectors with reverse voltage

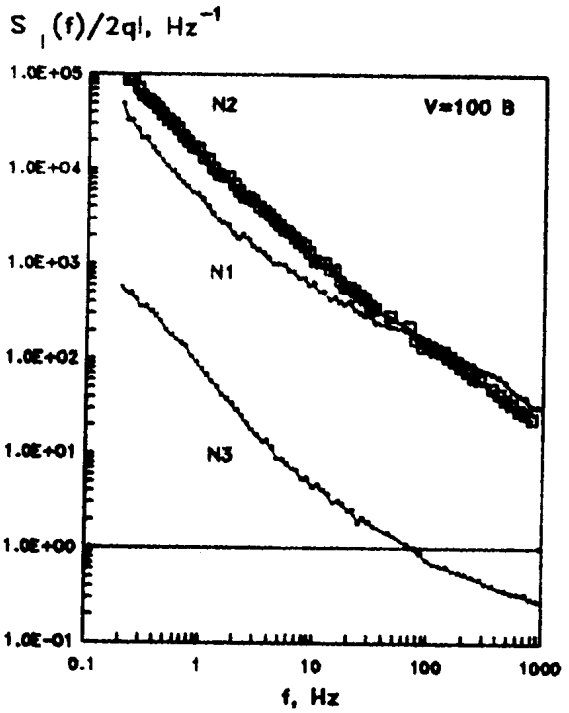

Fig.2. Spectral density of current fluctuations $S_I(f)$, divided on the shot noise magnitude $2qI$, where q is the electron charge, I is the current for reverse voltage $V = 100$ V

and exceeds the shot noise level by several orders of magnitude (Fig.1,2). An expression was obtained which allows to compare the fluctuation spectra with the energy resolution of detectors and to distinguish clearly the contributions of shot noise and the excess noise component. Satisfactory agreement was obtained between the values of energetic noise equivalent calculated from fluctuation spectra and those measured by amplitude analyzer. It was found that a contribution of excess noise may achieve 50% of the value of energetic noise equivalent, therefore, possibility for the essential improvement of resolution of detectors.

REFERENCES

1. *Afanasyeva N.P., Geraschenko O.V., Pustovoit M.A., Sibilev A.I.* Preprint PNPI–1815. Leningrad, 1992. 21 p.