**Sobolev, A. V.**; **Yafaev, D. R.**

**The phase analysis in the problem of scattering on a radial potential.** (Russian. English summary) Zbl 0588.47011

Zap. Nauchn. Semin. Leningr. Otd. Mat. Inst. Steklova 147, 155-178 (1985).

The behaviour of the total scattering cross section averaged over all directions $\sigma$ (k,g) was studied, first at g/k$\to\infty$, of a three-dimensional quantum particle of energy $k^2$ with a radial potential gV(r), g is the binding constant. Assuming $V(r)\sim V_0r^{-\alpha}$, $\alpha>2$, $r\to\infty$, the asymptotics $\sigma(k,g)\sim\kappa_\alpha(|V_0|g/k)^{2\lambda\alpha}$, $\lambda_\alpha=(\alpha-1)^{-1}$ was obtained in the range $g^{3-\alpha}k^{2(\alpha-2)}\to\infty$. The coefficient $\kappa_\alpha$ was expressed explicitly using the $\Gamma$-function. A proof was given. It is based on the phase functions in the potential scattering [*F. Kolodzhero*, Method of phase functions and theory of potential scattering (Russian) (1972)]. At $V\geq 0$ the asymptotics is valid even in the broader range g/k$\to\infty$, $gk^{\alpha-2}\to\infty$. Then the asymptotics g/k$\to 0$ (high energies), with potentials gV(r), $g\geq 0$, $r\to 0$ was derived to be $\sigma(k,g)\sim\kappa_\beta(V_0g/k)^{2\lambda\beta}$, $gk^{\beta-2}\to\infty$, at $V(r)\sim V_0r^{-\beta}$, $V_0>0$, $\beta>2$. The asymptotics of the forward scattering amplitude was calculated similarly.

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**MSC:**

47A40 Scattering theory of linear operators
35P20 Asymptotic distributions of eigenvalues in context of PDEs
81U99 Quantum scattering theory



**Keywords:**

total scattering cross section; three-dimensional quantum particle; binding constant; asymptotics; phase functions in the potential scattering; forward scattering amplitude

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