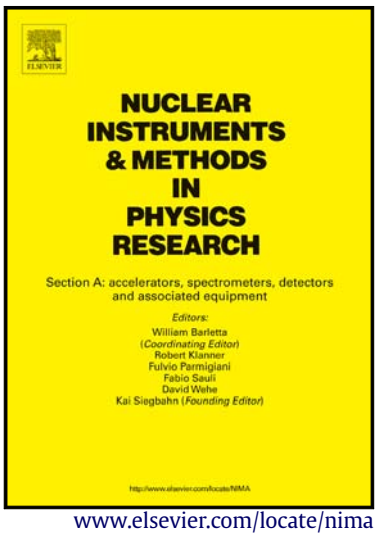

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Analytical formulae to calculate the solid angle subtended at an arbitrarily positioned point source by an elliptical radiation detector

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Abstract

In this paper, we introduce a direct analytical mathematical method for calculating the solid angle, Ω, subtended at a point by closed elliptical contours. The solid angle is required in many areas of optical and nuclear physics to estimate the flux of particle beam of radiation and to determine the activity of a radioactive source. The validity of the derived analytical expressions was successfully confirmed by the comparison with some published data (Numerical Method).

Keywords: Solid angle; Elliptical disk detector; Geometrical efficiency.

1. Introduction

The geometrical solid angle can be used to calibrate radiation detectors or to determine the activity of radioactive sources. The aim of the present work is to obtain the solid angle subtended by an elliptical disk detector with respect to an arbitrarily positioned radiating point source. Several efforts have been reported previously to deal with treatments of the geometrical efficiency $\varepsilon_g = \Omega/4\pi$ (Ω is the solid angle subtended by the detector at the source point) of right circular cylindrical detectors for point, circular disk and volumetric sources [1-29]. Prata [20-22] derived analytical expressions for the solid angle subtended by a cylindrical detector at a point source, a circular disk detector at a point cosine source and a cylindrical detector at a point cosine source with parallel axes, respectively. Also, Conway [23-26] derived an axially symmetric radiation vector potential using a spherically symmetric point source. This vector potential is used to derive a line integral for the solid angle subtended at a

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