技术及应用

方形闪烁光纤阵列出射荧光特性数值模拟

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摘要　　为对方形塑料闪烁光纤阵列的出射荧光特性进行分析，利用Geant4蒙特卡罗程序包将中子在闪烁光纤阵列中的能量沉积弥散过程和荧光（$E \leqslant 100\,eV$）在光纤内部的传播过程进行耦合输运模拟。分析14 MeV中子入射点的位置对荧光强度分布的影响，找出计算闪烁光纤阵列调制传递函数的1个等效点。讨论了荧光强度分布、荧光收集效率与角分布之间的关系。以5 cm厚闪烁光纤阵列为例，讨论了闪烁光纤阵列的调制传递函数和平板闪烁体的能量沉积分布函数、抽样函数之间的关系。结果表明，闪烁光纤阵列的调制传递函数近似可用平板闪烁体的能量沉积分布函数经函数rect(x,y)抽样后的结果作二维傅里叶变换得到。

关键词　闪烁光纤阵列　Geant4　荧光特性　图像转换屏　抽样函数

分类号

扩展功能

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Simulation on Fluorescence Characteristics of Square Scintillating Fiber Array

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Abstract　The coupled transport of neutron and fluorescence （$E \leqslant 100\,eV$）through the scintillating fiber array （SFA）was simulated using the Monte-Carlo code Geant4 for analysis of fluorescence characteristic of square plastic SFA. The relation between the intensity distribution of fluorescence and the incident neutron's position was analyzed, and an equivalent position to calculate SFA's modulation transfer function was found. The fluorescence intensity distribution and gathering efficiency combined with the recorded visible photon for a lens-coupled system were included in the evaluation, and an approximate expression between the modulation transfer function of SFA and the sampling function was discussed. It is found that modulation transfer function of SFA can be got by transforming the energy deposition distribution of planar scintillator.

Key words　scintillating　fiber　array　Geant4　fluorescence　characteristics　image　converter　sampling　function

通讯作者