

ALGEBRA  
SEMINAR

*A shifted convolution problem arising from physics*

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**Abstract:** Physicists Green, Russo, and Vanhove have discovered solution to differential equations involving automorphic forms appear at the coefficients to the 4-graviton scattering amplitude in type IIB string theory. Specifically, for  $\Delta$  the Laplace-Beltrami operator and  $E_s(g)$  a Langlands Eisenstein series, solutions  $f(g)$  of  $(\Delta - \lambda)f(g) = E_a(g)E_b(g)$  for  $a$  and  $b$  half-integers on certain moduli spaces  $G(Z)\backslash G(R)/K(R)$  of real Lie groups appear as coefficients to the analytic expansion of the scattering amplitude. We will briefly discuss different approaches to finding solutions to such equations and focus on a shifted convolution sum of divisor functions which appears as the Fourier modes associated to the homogeneous part of the solution. Initially, it was thought that, when summing over all Fourier modes, the homogeneous solution would vanish but recently we have found an exciting error term. This is joint work with Stephen D. Miller, Danylo Radchenko, and Ksenia Fedosova.

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