

# Direct Calculation of Mutual Information of Distant Regions

*Thursday, 5 December 2019 14:00 (15 minutes)*

We consider the (Renyi) mutual information,  $I^{(n)}(A,B) = S^{(n)}_A + S^{(n)}_B - S^{(n)}_{A \cup B}$ , of distant compact spatial regions  $A$  and  $B$  in the vacuum state of a free scalar field. The distance  $r$  between  $A$  and  $B$  is much greater than their sizes  $R_A, R_B$ . It is known that  $I^{(n)}(A,B) \sim C^{(n)}_{AB} \langle 0 | \phi(r) \phi(0) | 0 \rangle^2$ . We obtain the direct expression of  $C^{(n)}_{AB}$  for arbitrary regions  $A$  and  $B$ . We perform the analytical continuation of  $n$  and obtain the mutual information. The direct expression is useful for the numerical computation. By using the direct expression, we can compute directly  $I(A,B)$  without computing  $S_A, S_B$  and  $S_{A \cup B}$  respectively, so it reduces significantly the amount of computation.

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**Session Classification:** Short talks