South East Asian J. of Mathematics and Mathematical Sciences
Vol. 19, No. 1 (2023), pp. 01-16

DOI: 10.56827/SEAJMMS.2023.1901.1 **ISSN (Online): 2582-0850**

ISSN (Print): 0972-7752

ON SOME COMBINATORIAL INTERPRETATIONS FOR ROGERS-RAMANUJAN TYPE IDENTITIES

V. Gupta and M. Rana

School of Mathematics,
Thapar Institute of Engineering and Technology,
Patiala - 147004, Punjab, INDIA

E-mail : vasudhasingla.singla2@gmail.com, mrana@thapar.edu

(**Received:** *Nov. 24, 2022* **Accepted:** *Mar. 12, 2023* **Published:** *Apr. 30, 2023)*

Abstract: We implement an advanced technique to provide combinatorial interpretations of some Rogers–Ramanujan type identities, also known as sum–product identities. Specifically, we elaborate on the notion of modular Ferrers diagrams to explain these identities in terms of n–color overpartitions. Additionally, we reveal the interdependence between split part n–color partitions, 2–color F–partitions, and n–color overpartitions.

Keywords and Phrases: Rogers–Ramanujan type identities; n–color overpartitions; Split part n–color partition; 2–color F–partition; Modular Ferrers diagram; Combinatorial interpretation.

2020 Mathematics Subject Classification: 05A17, 19, 11P81, 84.

1. n–color Overpartition

A partition of a positive integer n is a weakly decreasing sequence of positive integers $(\lambda_1, \lambda_2, \cdots, \lambda_r)$ such that $\lambda_1 + \lambda_2 + \cdots + \lambda_r = n$. We use $l(\lambda)$ to denote the number of parts in a partition λ and $|\lambda|$ to denote the number being partitioned. As a convention, we consider the number of partitions of 0 to be 1. Partitions can also be represented graphically by a Ferrers diagram. A Ferrers diagram of a partition $(\lambda_1, \lambda_2, ..., \lambda_r)$ of n consist of r rows of left aligned cells, with the i^{th} row having λ_i cells. For example, the partition $\lambda = (6, 4, 3, 1)$ of 14 has the following Ferrers diagram: