



**IDEMPOTENT, ZERO DIVISORS AND NILPOTENT  
ELEMENTS OF THE QUATERNION AND  
OCTONION RINGS OVER  $\mathbb{F}_{p^r}$**

Alassane Diouf and Ousmane Ndiaye

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**Abstract**

We determine the number of idempotent elements and zero divisors in  $\mathbb{H}_{F_{p^r}}$ . Also we give a characterization of nilpotent and idempotent elements in  $\mathbb{O}_{F_{p^r}}$ .

**Keywords and phrases:** finite field, quaternion ring, duplication process, Nilpotent elements, idempotent elements, zero divisor, quadratic form and isotropic element.