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A NOTE ON QUOTIENT FULL COMMUTATIVE NEAR-FIELD SPACES OVER A NEAR-FIELD (QF-C-NFS-NF)

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ABSTRACT

In this paper, We define a near-field space N to be an FL (full linear) near-field space if N is isomorphic to the full near-field space of linear transformations of a left sub near-field space over a division near-field space. N is QFL if its left maximal quotient near-field space is an FLnear-field space. In this paper we give necessary and sufficient conditions for a near-field space to be a QFL near-field space. We also generalize some results of Chase and Faith concerning sub-direct sum decompositions of near-field spaces whose left maximal quotient near-field space is the direct product of FL near-field spaces.

Keywords: *near-field space, full linear near-field space, quotient near-field space, atomic.*

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SECTION 1: INTRODUCTION ON QUOTIENT FULL COMMUTATIVE NEAR-FIELD SPACES OVER A NEAR-FIELD

If $_NM$ is a left N-sub near-field space, then $C(_NM)$ will denote the set of closed sub near-field spaces of M. We say that $C(_NM)$ is atomic if $C(_NM)$ contains minimal non-zero sub near-field spaces, called atoms, and each non-zero sub near-field space of $C(_NM)$ contains at least one atom. $_NM$ is Q-prime sub near-field space if for any two atoms $I_1$and I_2 oí $C(_NM)$, there exists isomorphic sub near-field spaces X_1 and X_2 of M such that X_i, is essential in N_i for i = 1 and 2. If N is a sub near-field space of M, then $L_N(X)$ will denote the left annihilator in N of X.

Theorem 1.1: **N** is QFL if and only if the following conditions are satisfied: (i) $Z(_NN)=0$, (ii) $C(_NN)$ is atomic near-field space, (iii) $_NN$ is Q-prime near-field space.

Proof: Let Q be the left maximal quotient near-field space of N. Ii conditions (i)-(iii) holds good.

Then, $C(_Q(Q) = C(_NN)$ under contraction, and so $C(_QQ)$ is atomic near-field space. Since $Z(_NN) = 0$.

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We have that Q is a left self injective regular near-field space.

Thus A is an atom of $C(_QQ)$ if and only if A is a minimal left sub near-field space of Q. For the sake of simplicity of notation we will refer to the atoms of $C(_QQ)$ and $C(_NN)$ as atoms of Q and R respectively.

Suppose A_1 and A_2 are atoms of Q. A_1 and A_2 are injective as left N- sub near-field spaces. If $I_1 = A_{1\cap N}$ and $I_2 = A_{2\cap N}$, then l_1 and I_2 are atoms of N. Since $_NN$ is Q-prime, near-field space there exists isomorphic left ideals X_1 and X_2 of N such that X, is essential in I_i for i= 1 and 2. Clearly, X_i is essential in A_i for i= 1 and 2. The injectivity of A_i gives that A_1 and A_2 are isomorphic.
Thus $I_N(A_1) = I_N(A_2)$.

Let E be the sum of the atoms of Q. If { Aα } is the set of atoms of Q and A belongs to {Aα}, then

$$l_N(_(S) = {}_\cap 1_N{}^*(A_\alpha) = l_N(A).$$

If $l_N(_(S) \neq 0$, then $l_Q(S) \neq 0$. $l_Q(S) = GC_Q(Q)$, and so there exists an atom B of Q such that B= $I_Q(S)$. But B = S, and so $B^2 = 0$.

Since B is idempotent near-field space generated we have a contradiction.

Thus $l_Q(A) \cap N = l_N(A) = l_N(S) = 0$, and so$I_Q(A) = 0$.

Since A was an arbitrary atom of Q, we have that $I_Q(A) = 0$ for all atoms of Q.

If B is a non-zero left sub near-field of Q, then there is an atom A of Q such that A = B.

Since $l_Q(B) = l_Q(A) = 0$, we have that Q is prime sub near-field space of a near-field space N over a near-field.

Let W be an atom of Q. W is a minimal left ideal of Q, and W = Qe where $e^2 = e \neq 0$.

Since Q is prime sub ner-field space, we have that V = eQ is a minimal right sub near-field space of Q, and D = eQe is a division sub near-field space of a near-field space over a near-field.

Thus F is a left D near-field space.

Let L = Hom_D (V, V), and define a map $q \rightarrow q'$ from Q to L, where xq' = xq for $x \in V$.

This correspondence is clearly defined earlier on near-field homomorphism.

If $q_1, q_2 \in Q$ and $q_1{}^| = q_2$, then $xq_1 = xq_2$ for all $x \in V$.

Thus $eQ(q_{1-} q_2) = 0$ and $q_1 = q_2$ by the primeness of Q. Thus q to q' is monomorphism of Q into L.

Let $V^|$ be the image of V in L, and suppose $a \in L$ and $v^| \in V^|$ where $v \in V$.

If $x \in V$, then x = ex, v = ev, $va \in V$ and $x(va)^| = x(va) = (ex)(eva) = (exe)(va) = (exev)a = (xv)a = (xv^|)a = x(v^|a)$.

Thus $v^|a = (va)^| \in V^|$, and so $V^|$ is a right sub near-field space of L.

Since $V^| \subseteq Q^| \subseteq L$, we have that L is a left quotient near-field space of $Q^|$.

$Q^|$ is left self-injective, so $Q^| = L$.

Thus $Q \equiv L$, and so N is QFL.

Conversely, suppose R is QFL. $Z(_NN) = 0$ and $C(_NN) \equiv C(_QQ)$ under contraction.

Thus $C(_NN)$ is atomic.

Suppose $I_1$and I_2 are two atoms of near-field space N.

Let A_1 and A_2 be atoms of Q such that A_i) N = I_i for i=1 and 2.

Thus A_1 and A_2 are isomorphic under some isomorphism f, and I_i is essential in A_i for i = 1 and 2.

Let $X_1 = (f^{-1}(I_2)) I_1$ and $X_2 = f(I_1)) I_2$.

Clearly $X_1 \equiv X_2$ under the restriction of f to X_1, and X_i is essential near-field space in N for i = 1 and 2.

Thus N is Q-prime near-field space. This completes the proof of the theorem.

SECTION-2: RESULT ON QUOTIENT FULL COMMUTATIVE NEAR-FIELD SPACES, A NON COMMUTATIVE NEAR-FIELD SPACES.

In this section, we study and derive main result on quotient full commutative near-field spaces, a non commutative near-field spaces.

Theorem 2.1: Let Q be the left maximal quotient near-field space of N. Qis a direct product of FL near-field spces if and only if:

(i) $Z(_NN) = 0$, (ii) $C(_NN)$ is atomic.

Proof: If (i) and (ii) hold, then $Z(_QQ) = 0$, Q is isomorphic to $Hom_N(Q, Q)$, and $C(_NN) = C(_QQ)$ under contraction. Thus $C(_QQ)$ is atomic.

Then C(qQ) consists of the direct summands of $_NQ$, and so each direct summand of $_NQ$ contains a minimal direct summand. So Q is a direct product of FL near-field spaces.

Conversely, if Q is a direct product of FL near-field spaces, then Q is regular. near-field space. Thus $Z(_NN) = 0$, and $C(_QQ)$ consists of the direct summands of $_NQ$. Thus $C(_QQ)$ is atomic, and since $C(_NN) = C(_QQ)$ under contraction we have that $C(_NN)$ is atomic near-field space over a near-field. If N is a sub direct sum of near-field spaces} N_γ $\gamma \in A$} and $S = \Pi N\gamma$, then the subdirect sum near-field spaces is essential near-field space if N (identifying N and its canonical isomorphic image in S) is an essential left N-sub near-field space of S. Some elementary properties of essential sub-direct sums. This completes the theorem.

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